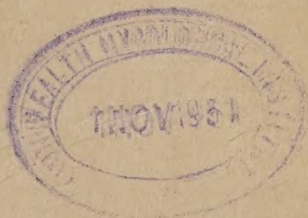


Report of the Work of The Rubber Research Board in 1950

(Established under the Rubber Research Ordinance, Chapter 302)



August 1951

Report of the Work of The Rubber Research Board in 1950

THE present report is the twentieth annual report of the Rubber Research Scheme (Ceylon) as constituted under the Rubber Research Ordinance (Chapter 302) and amended by the Rubber Research (Amendment) Act No. 27 of 1948.

CHAIRMAN'S REPORT

Chairman :

Mr. D. Rhind, O.B.E., Director of Agriculture, functioned as Chairman until 31st May. Mr. F. H. Griffith, M.P., was elected Chairman with effect from 1st June on the amendment of the Ordinance to provide for the appointment of a non-official Chairman.

Board Membership :

The following changes in the membership of the Board occurred during the year:

Mr. H. St. J. Cole Bowen resigned and Mr. R. J. Hartley was nominated in his place with effect from 1st January.

Mr. R. J. Hartley resigned and Mr. L. S. Boys was nominated in his place with effect from 2nd October.

Mr. A. G. Ranasinha, C.M.G., C.B.E., was deputed to represent the Minister of Finance in place of Mr T. D. Perera with effect from 27th July.

Dr. A. W. R. Joachim, Director of Agriculture, was nominated in place of Mr. D. Rhind, O.B.E., on the resignation of the latter.

Mr. W. J. A. Van Langenberg, M.B.E., was deputed to represent the Minister of Finance in place of Mr. A. G. Ranasinha, with effect from 16th December.

The personnel of the Board at the end of the year was as follows:—

Ex-Officio Members :

The Director of Agriculture — Dr. A. W. R. Joachim.

The Director, R.R.S. — Dr. E. Phillis (Vice-Chairman).

Representing the Minister of Finance—Mr. W. J. A. Van Langenberg, M.B.E.

Nominated Members :

Representing the Senate—Senator C. Wijesinghe.

„ „ House of Representatives—Major M. Jayawickreme, M.P.

„ „ Smallholders—Mr. F. A. Obeyesekera.

„ „ Planters' Association of Ceylon—Mr. F. H. Griffith, M.P.
(Chairman) and Mr. L. S. Boys.

„ „ Low Country Products Association—Mr. Francis Amara-
suriya and Mr. J. L. D. Peiris.

Committees :

An Experimental Committee consisting of the following members functioned during the year:

Mr. F. H. Griffith, M.P., (Chairman)
Mr. Errol Jayewickreme
Mr. J. D. Falconer
Mr. F. G. MacGregor
Dr. E. Phillis (Director)

Meetings of the Committee were held on 23rd January, 13th May, 17th June, 15th July and 23rd September.

London Advisory Committee for Rubber Research (Ceylon and Malaya)—The Board contributed jointly with the Rubber Research Institute of Malaya to the cost of research on the quality and utilisation of raw rubber carried out at the Imperial Institute, London, under the control of the London Advisory Committee for Rubber Research (Ceylon and Malaya).

FINANCE

Income—The Board's main income was derived from the cess on exports under section 6 (1) a of the Rubber Research Ordinance. Income from this source exceeded the estimate for the year by Rs. 628,907/-.

Monthly cess collections were as follows:—

January	..	Rs. 148,896.00	Brought forward	Rs.	841,724.00
February	..	.. 116,049.00	August	..	.. 128,607.00
March	..	.. 124,906.00	September	..	.. 137,451.00
April	..	.. 85,400.00	October	..	.. 123,305.00
May	..	.. 109,598.00	November	..	.. 122,773.00
June	..	.. 115,505.00	December	..	.. 137,447.00
July	..	.. 141,370.00			
		Rs. 841,724.00		Rs.	1,491,307.00

A profit of Rs. 70,177/- was derived from the normal working of Dartonfield Estate, Rs. 109,942/- from Nivitigalakele Estate and Rs. 3,002/- from Hedigalla Estate.

Expenditure—Current expenditure amounted to Rs. 636,105/-. The surplus of income over expenditure for the year was Rs. 1,245,619/-.

Capital expenditure amounting to Rs. 89,096/- was incurred mainly in respect of Agricultural Development Rs. 34,572/-, Renovating buildings Rs. 18,335/-, laboratory equipment Rs. 24,812/-, Water and Power Supply Rs. 8,337/-, Machinery and Tools Rs. 2,155/-.

Accounts—The accounts for the year with a Balance Sheet showing the property and liabilities of the Board have been prepared and submitted to the Auditor General for examination.

Technical Officers' Reports—The Director's report, which embodies the reports of other officers is attached.

(Sgd.) F. H. GRIFFITH,
Chairman of the Board

RUBBER RESEARCH SCHEME (CEYLON)

Dartonfield, Agalawatta.

DIRECTOR'S REPORT 1950

(THIS Report was prepared by Dr. H. E. Young (Acting Director) owing to the resignation of the Director, Dr. E. Phillis in Feby. 1951).

Staff

Dr. E. Phillis, PH.D., D.Sc. (Director), was on duty throughout the year.

Dr. H. E. Young, D.Sc., Agr., Oidium Research Officer, continued his duties and in addition took over general mycological work.

Mr. C. A. de Silva, B.Sc., Agric, C.D.A. Botanist, was granted one month and 23 days sick leave during the year.

Mr. W. I. Pieris, B.A., Smallholdings Propaganda Officer, completed a full years' duty.

Mr. D. M. Fernando, B.Sc., Research Assistant (Mycology), completed his two year probationary period and was confirmed in his position.

Mr. M. S. Wijeratne, B.Sc., Research Assistant (Chemistry), resigned his position from 19th January, 1950.

Dr. E. J. Risdon, M.A., D. PHIL., was appointed to the position of Chemist and subsequent to a three month course at the Imperial Institute London is expected to take up duties at Dartonfield early in 1951.

Mr. D. H. Constable, M.Sc., was appointed to the position of Agronomist and is also expected to take up duties early in 1951.

Messrs. A. J. Jeevaratnam B.Sc., (Agr.), P. W. W. de Silva B.Sc. (Agr.) and S. Natesan, B.Sc., B.Sc. (Agr.), were appointed Research Assistants on probation to commence duties in January 1951.

Mr. G. W. D. Barnet was appointed Estate Superintendent and is also expected to assume duties early in 1951. This will relieve the present problem of estate management which could not be given full attention by the technical staff.

During the year the Chemical Department remained closed and work was limited to general advisory duties on factory problems in this connexion.

The Soils Department also remained closed and the advisory work for this section was carried out by the Director, Dr. Phillis.

The existing staff was greatly taxed with the additional work of carrying on the general duties of the closed departments.

In all however, with the new appointments made, it is expected that all departments will be functioning efficiently in 1951.

A summary of the work of each Department is given hereafter under the respective departmental headings.

BOTANICAL DEPARTMENT

Report of the Botanist

(By C. A. DE SILVA)

THIS department is mainly concerned with the testing out of planting material. Experiments both large and small in the three sub-stations of the Scheme and on outside estates now total twenty eight. The senior staff officers responsible for the lay-out of some of these experiments up to 1945 have since left the Scheme. It has been the duty of the writer to keep these long term experiments up to date and to plant out new experiments since 1945. Experimental work involves routine tree to tree growth measurements taken annually until each area is ready to be tapped, followed by tree to tree test-tapping for at least three years, when further test-tapping is continued on material selected for promising yields and good secondary characters.

Some of this material has been in test-tapping since 1945, and the results are presented in this report. A specially interesting feature is the test-tapping of clonal seedling families established from hand pollinations and five tree clones derived from these seedlings planted simultaneously, thus saving about ten years for establishing clones from seedling parents, which will normally be taken to a tapping stage before clones are established. The yield results from legitimate clonal families will be used for proving the reliability of the various clonal parents used in hand pollination work, while the yields of five tree clones enables selection of early maturing clones for yield based on broad observational data. Selected clones are then tested in accurately laid out statistical field experiments. Final selections from these trials will then be put out on large scale trials of four to five acres of each clone on a semi-commercial basis, before recommendations can be made for large scale commercial planting. Budwood of clones selected for final trial is at the same time distributed to estates in various rubber planting districts for small scale planting. Final recommendations can then be made on information from the Scheme's own experiments and plantations on estates.

Together with this work experiments have been laid out to test out all foreign clones which have given promising results in their countries of origin.

In the absence of senior staff officers in this department, except for brief periods from 1945 to 1949, the writer has been barely able to keep various experiments up to date with the help of a greatly increased sub-staff of field assistants. On this policy the Scheme has undertaken to test nearly four thousand clones, about two thousand of which have already been planted since 1941. These difficulties have already been referred to by the Director in his report for 1949.

Yield figures are generally presented in pounds per tree per annum calculated on one hundred and forty tappings from average sample tappings carried out on normal tapping days once or twice a month under strict supervision by the experimental staff. These figures serve as a basis for accurate comparison between tested clones and controls. It will be necessary however to reduce the figures considerably, when attempting to interpret these figures in terms of yields that can be expected from large commercial plantings of any specific clone. Conditions of growth, the numbers of normal tapping days per year in any particular district, age of trees tapped, and the stand of tappable trees per acre, will be limiting factors.

No. 3 Replanting Experiment, Dartonfield 1936—This experiment, started in 1936, has been continued up to the present time. It is designed to assess the yields of trees planted as stumped buddings, budded stumps and field buddings. From 1949 onwards one of the four blocks was eliminated from the experiment. Table I gives the yield and girth figures from 1942 onwards, when the required percentage of tappable trees was recorded in the three systems of planting as far as possible in keeping with general estate practice.

TABLE I

		Stumped buddings		Budded Stumps		Field buddings	
		Yield in grams per tapping per tree	Girth in ins.	Yield in grams per tapping per tree	Girth in ins.	Yield in grams per tapping per tree	Girth in ins.
June	1938		8.55		6.21		
"	1939		11.84		9.19		4.89
"	1940		15.33		12.77		7.91
"	1941		19.04		16.56		11.65
"	1942	10.0(92)	21.80	*9.5(90)	19.74		15.29
"	1943	14.3(91)	23.33	11.8(92)	21.93	*9.8(77)	17.87
"	1944	17.9(92)	25.26	14.3(94)	23.72	12.2(77)	20.39
"	1945	18.7	26.53	17.0	25.39	11.3	22.22
"	1946	23.0	28.29	21.2	27.33	16.0	24.21
"	1947	24.5	29.74	23.2	29.22	17.5	26.13
"	1948	29.0	30.68	27.5	30.16	21.9	27.12
"	1949	30.7	31.11	29.1	31.40	22.5	27.68
"	1950	21.8	31.38	24.4	31.39	20.2	27.89

*Tapped in December of the year only.

Figures in brackets indicate number of trees on which yields per acre were calculated during the first three years of tapping.

It will be seen that from 1945, both growth and yield for stumped buddings and budded stumps have practically evened out. The planting of stumped buddings has the advantage of excess yields in the early years of tapping over the budded stumps. At the present time with high labour costs it is extremely doubtful whether this excess in crop will compensate for the high initial cost of planting stumped buddings. The cost of holing for stumped buddings, transport of material and upkeep of nurseries will be the chief limiting factors. The field buddings are of course about one and half years behind in growth compared with the other two systems of planting and show poorer yields.

1939 Replanted Area, Dartonfield, (2 acres)—Selected Prang Besar fraction clones are planted in this area of two acres. The test-tapping results based on one sample tapping per month are summarized for 6 years in Table II.

TABLE II

Clone	Tapping com- menced	No. of trees tapped 1950	Yield in lbs. per tree per year, 140 tappings					
			1945	1946	1947	1948	1949	1950
PB. 6/9	Mar. '44	39-45	6.5	6.4	8.0	7.8	13.1	9.3
PB. 5/60	Sep. '44	25-28	5.8	6.3	8.9	10.8	11.6	10.4
PB. 5/139	Mar. '45	29-31	4.1	4.4	6.3	6.1	8.7	7.2
PB. 6/50	Sep. '48	10	—	—	—	—	9.1	6.8

There has been a general drop in yields in this area due presumably to the rather severe attacks of *Oidium* experienced in this particular section of the estate. PB. 6/9 is highly susceptible to the disease and helps to keep the disease in an active condition for a considerable period. We have little information of the performance of these clones on outside estates in the yield returns sent to us each year from commercial plantations.

Stock Experiment, Dartonfield, 1941—This experiment consists of five blocks of the RRIM. clones 500, 501, 506, 520 and 514. In each of these monoclonal blocks there are six different stocks replicated sixteen times. These include a control treatment of unselected seedlings and illegitimate seedlings of clones TJ. 1, AV. 163, BD. 10, BS. 3 and MK. 1/1. A sixth block is planted with unbudded seedlings of the six stock families used, which are replicated sixteen times in single tree plots. The annual girth measurements were taken in July 1950. The area has been in tapping since March 1948 and the yields of the RRIM. clones, which are of particular interest are based on one sample tapping per month. Individual tree tapping was carried out for the first time in 1950 to study stock-scion effect, the results are presented in Tables III (a), (b), and (c).

TABLE III

(a) Mean Girth in Inches, 1950

Stock families	TJ. 1	AV.163	BD. 10	BS. 3	MK.1/1	Un-selected
Scion growth	21.4	22.6	21.4	21.9	22.3	21.8
Seedling growth	26.4	31.4	27.8	27.1	27.3	26.6

(b) Yield in Grams per Tree per Tapping, 1950

Stock families	TJ. 1	AV.163	BD. 10	BS. 3	M.K1/1	Un-selected
Scion yields	27.9	31.0	26.4	30.0	27.1	27.3
Seedling yields	27.1	27.0	27.0	21.8	22.7	23.9

The differences in growth and yield of scions on the various stock families are not significant and there is little indication of any marked stock-scion effects. In the unbudded seedlings AV. 163 family has grown best and the yields of families TJ. 1, AV. 163, and BD. 10, which are generally recommended as stocks show the better yields. The yields of the RRIM. clones which are of special interest are summarised in Table III (c).

(c) Yield of RRIM. clones 1950

Clones	RRIM. 500	RRIM. 501	RRIM. 506	RRIM. 520	RRIM. 514
No. of trees tapped 1950	93	92	87	89	72
Yield in lbs. per tree per year 1950 (140 tappings)	7.7	12.3	10.1	6.9	6.6

Clone RRIM. 501 is the best in the above series and nearly two hundred yards of budwood in small quantities have been distributed to ninety one estates for multiplication purposes. There has also been a considerable call for clones RRIM. 513 and 511, which show promising results in the 1940 clearing at Nivitigalakele as illustrated in Table VI.

Clonal Seedling Trial, Dartonfield, 1947—The following material is on trial in this area, with plots of forty nine trees replicated eight times:—

1. TJ. 1 (selfed seed)
2. PB. 86 illegitimate seed
3. PB. 5/139 " "
4. H. P. Seedling collection from the 1945 crosses as a hypothetical isolated seed garden of clones TJ. 1, BR. 2, AV. 163, and AV. 255.
5. Control (TJ. 1 budgrafts).

The stand of two hundred and sixty trees per acre will be thinned to one hundred and sixty per acre in 1951 on early test tapping results, on the Morris-Mann system and other secondary characters. The control clone T.J. 1 will also be thinned to one hundred and sixty trees, based on girth figures. The average growth of trees in February 1951 prior to tapping is given in Table IV.

TABLE IV
Average girth of trees in clonal seedling trial

	TJ. 1 selfed seedlings	PB. 86 ille. seed.	PB. 5/139 ille. seed.	H. P. seedling collection	Control TJ. 1 (budded)
Girth in inches at 3 feet	14.8	13.8	14.7	13.6	10.9

The growth for four years is on the high side due to the fact that the seedlings were planted as eighteen months old stumps. Unfortunately a considerable number of trees were uprooted from this area due to a somewhat high incidence of root disease from *Fomes lignosus*, and a fair amount of natural thinning out has occurred on this account in certain areas. Such thinning out is an exigency that may arise in any clonal seedling plantation in commercial practice and the stand of two hundred and sixty trees per acre at Dartonfield provides for such losses.

Nivitigalakele Sub-Station

1939 Clearing, Field 6A, Nivitigalakele—Thirty seven new local clones and seven control clones were originally on trial in this area. The yields of eight selected clones are summarized in Table V, over a period of six years.

TABLE V

1939 Clearing Field 6A, Nivitigalakele

Tapping system S/2, d/2, 100%, 2 sample tappings per month

Clone	No. of trees tapped 1950	Yield per tree per year on 140 tappings						Brown Bast cases 1950
		1945/46	1946/47	1947/48	1948*	1949	1950	
NAB. 3	20	2.9	4.1	6.0	10.1	12.1	11.4	3
" 8	18-20	2.9	4.5	7.9	9.1	11.0	11.0	7
" 11	19-20	2.7	4.8	7.2	10.0	10.8	10.9	3
" 12	19	3.0	5.0	8.5	12.4	13.3	15.1	1
" 15	20	4.4	6.8	11.6	12.8	15.9	15.0	1
" 16	20	5.1	6.6	9.4	9.5	10.8	9.1	—
" 17	17-19	5.1	7.9	12.2	13.6	15.2	14.9	7
" 20	17-18	3.4	6.3	10.2	16.6	15.5	16.7	4
Controls								
MK. 3/2	20	2.1	4.0	5.7	7.5	9.9	10.4	4
WG. 6278	20	3.4	4.6	6.9	6.9	7.9	8.0	2
GL. 1	20	4.0	4.8	7.0	8.1	9.2	10.4	2
PB. 86	20	3.9	6.1	8.4	9.8	13.2	13.0	1
TJ. 1	19-20	2.6	4.7	5.9	9.6	11.3	12.0	2

*Ten months tapping.

Clones NAB. 12, 15 and 20 have shown the best yield results in recent years, and these will be tried out in large scale trials on a semi-commercial basis at Darton-field, together with the best of the foreign clones introduced to this country. In the meantime over three hundred and seventy yards of budwood of the NAB. clones have been issued to forty two estates for multiplication and trial on a small scale.

1940 Clone Trial, Field 6B, Nivitigalakele

In this experiment foreign clones of promise, recommended for high yields, are tested out under local conditions. The four-tree plots replicated six times give a total of twenty four trees of each clone. The trees were first taken into tapping in January 1947. The yields of the best producing clones, up to the end of 1950, out of a total of thirty six including four controls are summarized in Table VI. Tapping has been continued on only two of the controls.

TABLE VI
1940 Clone Trial, Field 6B, Nivitigalakele
Tapping System S 2, d 2, 100°₀, 2 sample tappings per month

Clone	No. of trees tapped 1950	Yield in lbs. per tree per year, 140 tappings				Brown Bast cases
		1947/48	1948*	1949	1950	
AV. 255	24-22	5.6	8.7	9.9	13.3	3
PB. 6/50	23	5.9	7.6	8.9	11.1	3
RRIM. 501	22	5.4	8.8	11.7	10.8	2
RRIM. 513	24	5.8	9.9	11.2	10.5	1
PR. 107	24	4.7	7.9	10.1	10.1	—
RRIM. 500	22	5.6	6.7	7.1	10.0	3
B. 1	24	3.9	6.6	8.0	9.8	—
LUN. N.	21	3.8	7.5	8.2	9.7	2
WAR. 4	24	4.2	6.6	7.3	9.7	—
NAB. 26	24	6.4	7.8	8.8	9.5	1
PR. 105	24-22	4.2	6.9	8.4	9.2	2
AV. 352	22-20	2.6	5.6	7.7	9.2	2
RRIM. 519	21-20	4.5	6.5	7.1	8.0	4
RRIM. 506	20-12	5.1	7.2	6.6	7.0	12
RRIM. 504	24	5.1	7.5	8.0	6.9	—
RRIM. 511	23	5.9	6.4	7.3	6.9	3
RRIM. 514	24-23	4.9	5.8	7.1	6.6	3
Controls						
TJ. 1	24-23	3.8	6.6	8.1	10.8	1
WG. 6278	24-23	3.9	6.1	6.5	9.4	1

*Ten months tapping.

Clones AV. 255, RRIM. 501, and PR. 107 show very satisfactory yields and are recommended as high yielding clones in their countries of origin. The Prang Besar clone PB. 6 50 has also given very promising results in this clearing. Several estates which have tried these clones on a small scale will be able to compare the results obtained with those presented in Table VI. High yielding clones show considerable variation in certain secondary characters from district to district or even from estate to estate. It is essential therefore that the results obtained in our experimental clearings are carefully studied in conjunction with those obtained on outside estates before carrying out large scale plantings of these clones.

1941 Clearing, Field C6, Nivitigalakele

Hand pollinated seedlings of the 1939 programme are planted in this area. Five tree clones established from a proportion of these seedlings, based on pricking tests as early indications of high yielding qualities, are planted in an adjacent area. The average yields of the seedling families and the more promising derived clones are given in tables VIIA and VIIB respectively.

Seventeen clones were selected for further test-tapping based on yields of the first three years of tapping. It has been possible to include clones RR. 108, 116, 134 and 195 in a 1950 clone trial at Hedigalla, substation. These were propagated from budwood from the highest yielding trees representing these clones in the 1941 clearing. Budwood of the best of the remaining clones will be multiplied in nurseries in 1951, with a view to including them in large scale clone trials in the future.

Test tapping results of seedling families from crosses including clones WG. 6278, MK. 3/2 and BS. 3 show very satisfactory increased yields for 1949/50.

TABLE VII A

1941 Clearing, Field 6C, Nivitigalakele

Tapping S/2, d/2, 100%, 2 sample tappings per month

Family	No. of trees tapped 1950	Yield in lbs. per tree per year, 140 tappings			
		1947/48	1948*	1949	1950**
BS. 3×MK. 3/2	49	3.3	6.0	8.2	9.4
MK. 3/2×WG. 6278	3	2.6	6.9	8.0	13.2
BS. 3×PIL.A. 44	37	3.2	4.6	6.5	7.7
PIL.A. 44×WG. 6278	18	2.6	5.1	5.6	7.4
BS. 3×WG. 6278	44	3.6	7.7	10.0	13.6
PIL.A. 44×BS. 3	14	2.6	3.8	5.2	6.2
PIL.A. 44×MK. 3/2	6	3.2	5.9	7.5	8.3
WG. 6278×MK. 3/2	3	3.8	8.1	9.2	11.9
BS. 3×TJ. 1	3	2.7	4.7	6.7	9.9

*Ten months tapping

**Ten months (Jan. to Oct.)

TABLE VII B

1941 Clearing, Field 6C, Nivitigalakele

S/2, d/2, 100%, 2 sample tappings per month

Clone	Mother tree No. and Seedling family	Yield in lbs. per tree per year ; 140 tappings			
		1947/48	1948*	1949	1950
RR. 134	50, MK. 3/2×WG. 6278	3.5	6.6	11.2	15.8
RR. 108	116, BS. 3×MK. 3/2	6.3	11.2	13.5	14.5
RR. 116	28, BS. 3×MK. 3/2	4.7	8.3	12.5	13.7
RR. 163	110, PIL.A. 44×WG. 6278	4.4	8.0	9.2	12.1
RR. 181	147, BS. 3×WG. 6278	4.5	8.6	10.8	11.8
RR. 125	40, BS. 3×MK. 3/2	3.7	6.2	11.5	11.3
RR. 119	31, BS. 3×MK. 3/2	3.4	7.2	9.6	11.4
RR. 173	129, BS. 3×WG. 6278	4.1	6.4	9.6	11.1
RR. 121	36, BS. 3×MK. 3/2	5.3	6.8	10.8	10.3
RR. 146	77, MK. 3/2×PIL. A. 44	5.0	6.2	9.3	10.0
RR. 153	91, PIL.A. 44×WG. 6278	5.9	10.0	10.8	10.7
RR. 111	21, BS. 3×MK. 3/2	5.6	8.3	9.6	10.1
RR. 195	183, WG. 6278×MK. 3/2	5.5	7.9	14.0	9.7
RR. 126	41, BS. 3×MK. 3/2	4.9	8.4	11.6	9.7
RR. 120	34, BS. 3×MK. 3/2	3.0	6.2	9.5	9.5
RR. 131	47, BS. 3×MK. 3/2	3.5	5.6	8.6	9.5
RR. 196	164, WG. 6278×MK. 3/2	—	6.3	10.3	8.9

*Ten months tapping.

It should be noted that the results in Table VII B are based on only five trees of each clone, and should not be compared strictly with yields in other experiments where clones are being tested on a larger scale.

1942 Clearing, Field No. 7, Nivitigalakele

Clonal seedlings of the 1940 hand pollination programme were planted in this area together with a few illegitimate seedlings of clone AV. 185. The trees were first brought into tapping in January 1949. Clone TJ. 1 is the only foreign clone parent used in the crosses, the remainder consist of local clones. The yields for 1949 and 1950 are summarized in table VIII.

TABLE VIII

1942 Clearing, Field No. 7, Nivitigalakele

Tapping S 2, d/2, 100%, 2 sample tappings per month

Family	No. of trees tapped 1950	Yield in lbs. per tree per year 140 tappings	
		1949	1950
BS. 3×HC. 28	72-71	3.0	4.8
BS. 3×TJ. 1	68-71	4.0	6.8
MK. 1/3×BS. 3	6	2.1	5.5
MK. 1/3×MK. 3/2	5	2.2	4.6
HC. 28×WG. 6278	2	3.3	6.4
MK. 1/3×WG. 6278	7	2.0	4.3
AV. 185 ill. seedlings	17	3.0	4.6
WG. 6278 budded control	66-64	4.5	5.9

It should be noted that these hand pollinated seedlings were planted as stumped seedlings in an area used for food crops during the war. In 1944 the seedlings were again pollarded at three feet height from the ground. The cut ends were used to establish five tree clones in an adjacent area. WG. 6278, the control clone, shows a very satisfactory yield compared with the seedlings in this area. There are further indications of the usefulness of local clones as seed parents in the results for the second year of tapping.

1946 Replanted Area, Nivitigalakele

This area was planted in October, 1946. Eight clones are replicated five times in randomized blocks with plots of sixty four trees. Clones CHM. 2 (LCB. 1320) and CHM. 3 gave very poor budgrafting results and budded stumps of these clones were supplied to plots throughout 1947. Girth measurements taken in January 1949, and 1950 are summarized in Table IX.

TABLE IX

Girth Measurements at three feet from union in inches

Clones	AV. 255	AV. 352	PB. 6/9	PB. 5/60	CHM. 2 (LCB. 1320)	CHM. 3	TJ. 1	PR. 107
1950	8.80	7.73	9.08	8.32	7.71	7.36	6.86	6.29
1949	5.71	5.12	5.32	5.49	4.83	4.37	4.17	4.13
Increase 1949/50	3.09	2.61	3.76	2.83	2.88	2.99	2.69	2.16

From girth measurements taken in January 1950 the general growth for approximately three years is satisfactory. The inclusion of clones AV. 255, LCB. 1320 and PR. 107 makes this clone trial of particular importance for future records of growth, yield, and incidence of disease.

1946 Replanted Area, A and B budgrafts of Clone MK. 3/2

The A and B series in this experiment represent budgrafts taken from the highest and lowest yielding trees respectively of the forty four original buddings of clone MK. 3/2 in the Nivitigalakele 1928 clearing; sixty budgrafts in each series were planted in one hundred and twenty spare holes alternately as single tree plots. Girth measurements taken in January, 1950, gave the following average figures for fifty three trees in each of the series.

Mean Girth in Inches			
A Series	..	6.19	
B	„	5.87	

Hedigalla

Trial of Legitimate Seedlings and Derived Clones—Hedigalla 1943/44

Legitimate seedlings from the 1941 hand pollinations and five point derived clones with clone WG. 6278 as a control are planted in this area. A proportion of the seedlings were planted in a randomized block experiment and the remainder were planted in guard rows and dummy plots.

Girth measurements were taken in January 1950, and the figures are summarized in Tables Xa, Xb, and Xc.

TABLE X a
Mean Girth in Inches (Experimental Plots)

Family	No. of trees	Girth		
		Jan. 1949	Jan. 1950	Increase 49/50
MK. 3/2 × TJ. 1	24	18.3	22.1	3.8
BS. 3 × DBK. 1	63	17.1	21.6	4.5
BS. 3 × H. 24	23	16.8	21.0	4.2
RH. 10 × MK. 3/2	28	18.4	22.5	4.1
PB. 86 × PR. 107	23	20.0	24.4	4.4
TJ. 1 × PB. 86	23	18.8	23.2	4.4
PB. 86 × TJ. 1				
M. 65 × PIL. B. 84	27	19.4	23.6	4.2
PIL. B. 84 × M. 65				
Mean	..	18.4	22.6	4.2
Control WG. 6278	22	13.7	16.5	2.8
(Budded Control)				

TABLE X b

Mean Girth in Inches (Dummy Plots)

Family	No. of trees	Girth		
		Jan. 1949	Jan. 1950	Increase 49/50
MK. 1/3×HC. 28 ..	8	19.7	23.9	4.2
MK. 1/3×MK. 3/2 ..	4	15.3	19.6	4.3
MK. 1/3×BR. 2 ..	4	20.4	24.8	4.4
BS. 3×TJ. 16 ..	8	20.4	25.0	4.6
BS. 3×RH. 10 ..	4	19.9	24.6	4.7
BS. 3×PB. 86 ..	1	10.4	13.9	3.5
RH. 10×TJ. 1 ..	4	25.9	30.1	4.2
DBK. 1×MK. 3/2 ..	4	17.7	21.4	3.7
TKD. 113×BS. 3 ..	4	19.8	23.6	3.8
PB. 86×M. 162 ..	4	22.4	25.9	3.5
Mean ..		19.2	23.3	4.1
Surplus trees ..	164	19.5	23.9	4.7
Guard row trees ..	73	13.6	17.1	3.5

TABLE X c

Material	No. of trees		Mean girth in inches		
			Increase		
	1949	1950	1949	1950	49/50
Derived clones of H.P. Seedlings ..	1,247	1,240	14.7	18.8	4.1
Control clone WG. 6278 ..	254	254	14.3	17.8	3.5

The growth of seedlings and derived clones in the 1943/44 area has been very satisfactory. The trees were taken into general estate tapping in August. With improvements in staff conditions at Hedigalla the trees will be test-tapped in 1951.

1944 Small Scale Clone Trial

Sixteen clones are tested in this experiment in a balanced incomplete experiment of 4^2 design. Each of the sixteen clones is replicated five times according to the layout in single tree plots. Girth measurements taken in January, 1950, are summarized in Table XI.

TABLE XI

Mean Girth Measurements in Inches
Budgrafts planted in July, 1944

Clone	Girth		Clone	Girth	
	1949	1950		1949	1950
RR. 28 ..	16.0	22.2	RR. 29 ..	10.4	14.2
PB. 6/5 ..	13.3	17.0	RR. 27 ..	12.2	16.4
PB. 5/122 ..	13.5	17.0	AV. 214 ..	10.5	13.8
RR. 25 ..	13.1	17.2	WG. 6278 ..	11.5	15.2
RR. 24 ..	13.3	17.5	DAR. 1 ..	10.9	13.9
RR. 23 ..	11.8	15.8	AD. 24 ..	9.7	12.3
RR. 21 ..	12.5	17.7	RR. 20 ..	9.9	12.9
RR. 26 ..	11.3	15.0	RR. 22 ..	9.5	12.7
			Mean ..	11.8	15.5

The increase in girth for 1949/50 is satisfactory. The growth after five and half years is not up to the required standard. Owing to poor growth this area was manured with the R.R.S. R215 complete mixture in 1948 and 1949. It should also be noted that the Hedigalla areas up to the 1946 clearings were used for heavy crops of manioc (cassava) during the war and require special manuring on this account.

Stem-Branch Budding Experiment, Hedigalla, 1944

This experiment was started in 1944 to study bud variation, if any, in buds taken at different points on stem and branch budwood. Ten hand pollinated seedlings in the 1942 clearing were used as budwood material. H1 and H2, represent buds taken from two sections of main stem and 'B' represents branch buds. The girth measurements taken in January, 1950, are summarized in Tables XII a, and XII b.

TABLE XII a

Mean Girth Measurements in Inches
Budgrafts planted in July, 1944

Clones	1/130	1/5A	2/72	1/3A	2/32	1/1A	2/23	2/63	1/4A	2/108	Mean
Jan. '50 ..	18.9	18.9	18.5	17.2	18.9	19.3	17.3	17.3	15.4	19.2	18.1
Jan. '49 ..	14.7	15.0	13.6	12.9	14.8	13.8	13.4	14.3	12.2	14.5	13.9
Increase 1949/50 ..	4.2	3.9	4.9	4.3	4.1	5.5	3.9	3.0	3.2	4.7	4.2

The increase in growth in 1949/50 and the girth for the period of growth since planting are very satisfactory in this area.

TABLE XII b

Budwood type	Mean girth in inches		Increase 1949/50
	1949	1950	
H1	13.7	18.0	4.3
H2	14.1	17.6	3.5
B	13.9	18.6	4.7

A statistical analysis of the above figures shows that the differences in growth between the three bud types are not significant.

Crown Budding Experiment, 1945

This experiment provides for a study of the effect of crown-budding on the centre section, which in practice will be high-yielding.

Each plot consists of thirty six trees made up of six tree rows of six clones, which make up the centre sections. These clones are representatives of high yielding and low yielding varieties. The latter were included to balance the experiment and will be of considerable interest. Each of these plots will have a single crown made up of one of the clones used as a centre section : the next plot of thirty six trees will have a crown of another clone making up the centre sections and so on. A splitting of the six tree rows into three high and three low buddings will give further useful information.

The crowns should have been preferably budded at the end of 1947, but owing to extreme shortage of staff, the crowns were not budgrafted until late in 1949. Even so the experiment when taken up to tapping stage will provide most useful information on crown-centre section effect. It may be that certain centre-sections which normally carry a light crown will not be able to support a heavy crown until about the fourth year, and in such cases late crown-budding may be necessary. As is known at present the clone LCB. 870 which is immune to *Oidium* has a somewhat heavy crown, and is also a medium yielder. The results of this experiment should give useful data for the future use of this clone for crown budding. The crowns at present are well established and the snags have been cut back. A round of girth measurements was taken in September, 1950 and growth increase of the centre-sections under the various crowns will be recorded from year to year until maturity. The girth measurements are summarized under in Tables XIII A and XIII B.

TABLE XIII a
Mean Girth in Inches

Centre Sections		C R O W N S					
		TJ. 1	AV. 256	PM. 17	PB. 86	GL. 1	RUB. 393
TJ.	1	10.56	11.34	9.93	11.65	10.60	10.53
AV.	256	10.73	11.43	10.88	11.24	9.90	10.68
PM.	17	8.58	9.07	8.63	9.56	8.17	8.40
PB.	86	10.47	11.13	10.59	10.91	10.24	10.78
GL.	1	9.73	9.72	9.44	10.15	9.18	9.30
RUB.	393	9.78	10.67	10.08	10.58	9.75	10.28

TABLE XIII b

Mean Girth Expressed as a Percentage of Controls

(Crown and centre section of same clone)

Centre Section		C R O W N S					
		TJ. 1	AV. 256	PM. 17	PB. 86	GL. 1	RUB. 393
TJ.	1	100.	107.4	94.0	110.3	100.4	99.7
AV.	256	93.8	100.	95.2	98.3	86.6	93.4
PM.	17	99.4	105.1	100.	110.8	94.7	97.3
PB.	86	96.0	102.0	97.1	100.	93.8	98.8
GL.	1	106.0	106.0	102.8	110.5	100.	101.3
RUB.	393	95.1	103.8	98.1	102.9	94.8	100.

Table XIII a which gives the first series of girth measurements with the various crowns will form the basic data on which future rates of growth will be estimated.

Table XIII b shows the growth under the various crowns expressed as a percentage of the control. The figures are of no significance at present and only indicate the method of presentation of data for future records.

Large Scale Clone Trial, 1945, Hedigalla

Six clones are compared in this experiment with clone TJ. 1 as a control. The clones were established from selected mother trees of Prang Besar seedlings planted at Nivitigalakele and were test tapped as three point clones prior to trial on a large scale. Twenty five tree plots of each clone are replicated three times in a balanced incomplete block layout. Girth measurements taken in January, 1950 are summarized in table XIV.

TABLE XIV

Large Scale Clone Trial, Hedigalla

Mean Girth Measurements in Inches

Clones	PBS 66	PBS 69	PBS 70	PBS 90	PBS 111	PBS 181	Control TJ. 1
1950	11.17	9.34	10.01	11.25	8.75	10.35	8.89
1949	7.41	6.02	6.94	7.22	6.04	6.79	5.93
Increase 1949/50	3.76	3.32	3.07	4.03	2.71	3.56	2.96

Several areas in this 1945 clearing originally showed poor soil conditions. Added to this, crops of cassava were planted in the food growing drive during the war. Phosphate alone failed to give the required rate of growth in the early years. In 1948-49, a complete mixture was applied and the increment figures for 1949-50 period are more satisfactory than in former years. The growth figures taken in January, 1950, show that the total growth for the age of trees is well below the standard required in the wet low country districts.

Hand Pollinated Seedlings and Derived five tree clone trial 1946, Hedigalla

The material planted in this area comprises seedlings resulting from hand-pollinations made in 1943 and five tree clones established from each seedling.

Girth measurements taken in January, 1950, gave average figures for seedlings and clones at the age of approximately three and half years, as shown in Tables XV a & b.

TABLE XV a

Mean Girth in Inches five tree clones (1946 Clearing)

	January 1949	January 1950	Increase 1949/50
5 tree clones ..	5.78	8.65	2.87
Clone TJ. 1 (control)	4.79	7.53	2.74

TABLE XV b

Mean Girth in Inches, Clonal Seedling Families (1946 Clearing)

Cross	No. of plants	Girth (inches)		
		1949 Jan.	1950 Jan.	Increase 1949/50
PB. 86×BS. 3 ..	64	7.66	11.22	3.56
PB. 86×WG. 6278 ..	19	7.93	11.47	3.54
PB. 86×TJ. 1 ..	14	7.64	11.80	4.16
PB. 86×MK. 3/2 ..	9	6.67	9.73	3.06
Budded control clone				
TJ. 1 ..	15	5.82	8.38	2.56
Extra clone TJ. 1 ..	75	5.45	8.20	2.75

As can be expected the seedlings have grown better than the control budgrafts. The general growth in this area is satisfactory, but not up to the required standard. Only a small crop of manioc was taken from this area.

Recent Experiments at Hedigalla

In addition to experiments described and commented on, further experimental plantings were carried out at Hedigalla in 1947, 1949 and 1950.

1944 hand pollinated seedlings and derived five tree clone trial, Hedigalla, 1946-1947

Four hundred and five hand-pollinated seedlings were planted in this area in 1946 and five tree clones established from two hundred and forty of the hand pollinated seedlings were planted in an adjacent area in 1947. Girth measurements were taken in 1950 with the following results:

Mean girth of clonal seedlings	8.5 inches
Mean girth of 5 tree clones	6.6 inches

1945 Hand Pollinated Seedling Trial, Hedigalla 1947

Thirty six thousand four hundred and ninety hand pollinations, using foreign and local clone parents, were carried out in 1945, and five thousand five hundred and nineteen seeds were harvested. Resulting from this, five thousand two hundred and thirty three normal trees were established in nurseries. This material was distributed as follows:—

1,100 seedlings and derived clones were planted on 10 commercial estates.

500 seedlings were put out in the Dartonfield clonal seedling trial, 1947.

3,565 seedlings were used in the Hedigalla clonal seedling trial, 1947.

About one thousand three hundred of the hand pollinated seedlings planted in Hedigalla were lost in a severe drought. Over two thousand five tree clones have still to be planted from each of the legitimate seedlings at Hedigalla. This will form the main new planting at Hedigalla in twenty five acre trials during the next three to four years.

1949 Large Scale Clone Trial, Hedigalla

Twenty four new clones mostly derived from high yielding Prang Besar and Tjikadoe seedlings planted at Nivitigalakele in 1932 and 1933, are planted in this area with six controls which include clones RRIM. 501 and PB. 86.

It will be appreciated that the experiments recorded in this report with further plantings carried out in 1950 will be far beyond the capacity of work of a single Botanist. It is hoped that with the appointment of an Agronomist and Graduate Research Assistants in 1951, the work of the Botanical Department will be considerably eased.

Advisory Work

The greater part of the correspondence of the Botanical Department was taken over by the Director, Dr. Phillis in 1950.

MYCOLOGY DEPARTMENT

Report of the Mycology Department

(By H. E. YOUNG)

The general advisory work of the Mycology Department was carried out by the Oidium Research Officer in addition to his specialized duties. Mr. D. M. Fernando, Research Assistant, was attached to this Department throughout the year.

The advisory work included subjects such as bark and panel diseases and brown bast as well as those given special mention below.

Fomes lignosus

During the year many diagnoses of this root disease were carried out for estates. The disease is becoming more conspicuous now with replanting of old rubber fields. In many cases the old trees are infected but the disease is not evident unless the uprooted stumps are individually inspected. Failure to notice these diseased stumps often results in many deaths of replanted stumps and seedlings. Control measures have been advised where necessary.

At Dartonfield a census of lightly infected trees which had had their roots treated with copper sulphate showed that in every case the tree succumbed sooner or later to the disease. Treatment by this method was therefore abandoned and total eradication resorted to.

Poisoning of old rubber and interplanting with the new plants has shown itself as liable to result in severe Fomes damage in some cases. This is due to the fact that the roots of the poisoned trees are not available for easy inspection and consequently Fomes infected stumps are left in the ground to infect the new plants. With the higher intensity of stand per acre involved in the use of clonal seedlings the effect of Fomes infection is proportionately greater and in addition due to the close planting of the trees spread of the fungus from tree to tree becomes easier and quicker. This was experienced in one field at Dartonfield where the stumps of the old rubber had not been removed and clonal seedlings were planted. Death of young trees due to Fomes has now reached the level of ten per cent of the total stand.

Phytophthora leaf fall

This was of little consequence during the year no doubt due to the lower than average rainfall experienced.

Diplodia dieback

Die back of rubber trees even to the ground was reported in some cases. This followed several severe attacks of oidium which caused twig die back followed by the invasion of the tree by *Diplodia theobromae* which caused further severe damage. Advice on control of the problem was given where required. This consists in pruning back the tree well into healthy wood and antiseptic treatment of the pruning scars and burning of infected wood. The real control of the disease is control of Oidium.

Hypocrella reineckiana

This fungus parasitic on scale insects was very common during the year and numerous enquiries were received as to its identity and pathological importance. The sooty mould which usually accompanied *Hypocrella* and the scale insects also caused comment.

Nitrogen fixation by cover crops

A preliminary trial of several strains of nitrogen fixing bacteria (*Rhizobium radicola*) was carried out at Dartonfield. The cover crops used were *Pueraria phaseoloides* and *Desmodium ovalifolium*. It was shown that the strain naturally present in Dartonfield soil was not as efficient as one imported from Australia. This was noted in the vigorous growth of the plants inoculated with the better organism as well as by the type of nodulation occurring.

In addition leaf fleck symptoms common in cover crops did not appear on the plants inoculated with the good bacterial strain. This is of interest as these leaf fleck symptoms have sometimes been put down to mineral nutrient deficiencies.

Birds Eye Leaf Spot

A few cases of nursery infection caused by this fungus (*Helminthosporium heveae*) were recorded and appropriate remedial measures advised. This is not an important disease in Ceylon Rubber.

Mites

Attack of nursery seedling leaves by mites occurred to some extent this year no doubt due to the drier conditions prevailing. The mites however were readily controlled by sulphur dusting.

Rubber and Cacao Interplanting

Fears are felt by the writer concerning the disease effects which may accrue from the present vogue of interplanting cacao and rubber. This is due to the fact that the Phytophthora diseases of rubber are also important cacao diseases. Phytophthora diseases of rubber do not normally occur in the drier rubber districts (circa 80 in. rainfall p.a.). The raised humidity caused by the underplanting of rubber with cacao however, it is felt, may lead to an increase in bark and panel diseases of rubber which are not prevalent in those areas. Experience only will show this. In the wet low country districts troubles of this nature are almost bound to occur if the practice is taken up there to any extent. An additional factor in the wet low country will be the adverse effect on the drying of the tapping panel caused by the understory of cacao.

Death of Budded Stumps

A number of cases of dead budded stumps were sent in for report ; in the majority the trouble was due to entry of fungi through the snag and invasion of the stump itself causing girdling of the young plants and subsequent death. The chief fungus involved was *Ustulina zonata*.

Cutting the snag off at the bud union as soon as brown wood has developed on the bud shoot in order to facilitate quick occlusion of the snag scar is the obvious remedy. This prevents the snag acting as a source of entry for parasitic fungi. Painting of the pruning cut with a protective paint is an added insurance.

South American Leaf Cast Disease

Although fortunately the cause if this disease *Dothidella ulei* is absent from the East the danger of its introduction is ever present. The work on this disease in South America was followed closely. From the life history of the fungus and the course of the disease it is here suggested that the mechanism of resistance of the resistant clones and varieties selected in South America is similar to that of the Oidium resistant clone LCB. 870 i.e. that quick maturation of the leaf cuticle is the important factor. It is therefore considered by the author that clone LCB. 870 may also prove resistance to this disease.

Weedicides

Trials of formulations of 2-4D selective hormone type weed killers gave promising results and it was found that one of the worst weeds *Mikania scandens* could be easily killed by this method. Costs in Ceylon of the chemicals however render the commercial use of these materials uneconomical.

REPORT OF THE OIDIUM RESEARCH OFFICER

(By H. E. YOUNG)

The study of leaf mildew of Rubber, caused by *Oidium heveae*, and its control was pursued and considerable progress made in several directions. In addition a largely attended field day was held at Kepitigalla and Oidium and its control discussed with the aid of demonstrations. The salient points of the work for the period under review are outlined briefly below.

Oidium heveae

Native host

Considerable advances in the study of this disease were made during the twelve months. A notable feature was the discovery of the natural host of the causal organism. This was found to be a common weed *Euphorbia pilulifera*. A discussion of this was published separately in the Quarterly Circular of the Scheme.

Mechanism of Resistance to Leaf Mildew

The reason for the resistance of clone LCB. 870 to leaf mildew was intensively investigated. It was found that the resistance mechanism was bound up with the quick maturation of the leaf cuticle of this clone as compared with normal clones. Of other clones investigated only PB. 86 showed any abnormal characteristics in regard to cuticle. In this instance the cuticle appears to have a different make up to that of other clones. This may account for its slightly resistant character. The detailed work and observations on this subject were published separately in the Scheme's Quarterly Circular.

Breeding for Resistance

Breeding for resistance was commenced and successful hand pollinations were carried out involving the resistant clone LCB. 870 and high yielding but non resistant clones. Unfortunately due to rodent attack a large proportion of the resultant seeds were destroyed on the trees. This was probably due to the abnormally low seed set during the season as a result of flower fall due to heavy oidium attack. The rodents then had only the hand pollinated seed to feed upon. Approximately 20% success was achieved in the hand pollinations. It is proposed to carry out a much larger programme in this direction during the next season.

The seedlings resulting from the crosses will be tested for resistance in the nursery beds by microscopic means involving measurement of cuticle thickness at various stages of leaf development. This method resulted from research on the reason for the resistance of clone LCB. 870 mentioned above. Promising seedlings will then be multiplied for further trials.

Crown Budding for Resistance

Crown budding of high yielding trees with clone LCB. 870 in order to achieve an oidium resistant crown was proceeded with. Crown budding of two hundred and fifty pairs of twinned seedlings at Hedigalla was practically completed. One of each pair of twins was crown budded with clone TJ. 1 and the other with LCB. 870. From this it is hoped to obtain data on the effect of the low yielding but vigorous clone LCB. 870 on the yield of the tapping panel. Buddings were made at various heights from 4-8 feet from the ground (the same for each pair of twins) in order to find if difference of interval between the tapping cut and the crown union has any effect on yield. Girth measurements of this experiment are being made annually to assess the effect of the different crowns on growth.

In addition crown budding was successfully carried out directly onto trunks and branches of ten year old PB. 86 bud-garfts at the Scheme's Kepitigalla Clone Museum.

The technique of crown budding was developed and adequate methods devised to prevent damage to the bud shoots by wind which often caused serious damage until suitable protective arrangements were devised.

In cooperation with two estates crown budding was carried out on estate trees. In one case 600 crown buddings were carried out on three clones in a severe mildew area and in the other case in another bad area owing to the comparatively mature age of the trees only a small proportion of the buddings were successful and the trees were pollarded for future buddings in the new wood.

Test tapping of clone LCB. 870 in order to determine its yield was carried out at the clone museum at Kepitigalla by arrangement with Mr. M. Atkinson (Superintendent, Kepitigalla Estates). The yield of nine year old trees worked out at approximately 400 lbs. D.R.C. per acre per annum. The latex is white. This is an important factor in crown budding as it has been shown that the undesirable yellow colouring matter in latex is produced in the crown. For instance a white latex crown

grafted on the tapping panel of a clone which normally produces a yellow latex with a self crown then produces white latex and vice versa. Recent anatomical observations in Indonesia have also shown that the yellow pigment is not produced in situ in the latex vessels of the trunks of the trees.

Budwood of clone LCB. 870 was distributed to many estates during the year for propagation and crown budding purposes. In addition, owing to the increasing demand for this clone by estates a large new budwood multiplication nursery for the clone in question was established towards the end of the year. In the interim in order to fulfil budwood demands permission to sell the budwood from the Scheme's clone Museum at Kepitigalla Estate was given to the Superintendent of the Kepitigalla Estates until the end of 1951. A considerable amount of budwood was issued in this way from Kepitigalla.

Oidium Control by Sprays and Dusting

Unfortunately most of the materials ordered for trial as controlling agents for oidium did not arrive in time for the 1950 season. However towards the end of the wintering period a power driven mist blower was landed. This was used successfully with formulations of concentrated lime sulphur and it is due to this that the high proportion of successes in the hand pollinations referred to above occurred. The lime sulphur gave adequate protection for up to fourteen days. The machine proved too small for treating mature trees but was very useful in immature areas.

A general examination of sulphur dusts on the market was made during the year and many estates and companies forwarded samples of sulphur dusts for report as to suitability for dusting purposes.

In many cases the dusts were found to be too coarse for the purpose and importing firms in many cases made arrangements for procurement of dust of suitable specification for the next season.

The types of dusting equipment available were surveyed and in general found somewhat unsuitable in their present form. One duster with a twin bend outlet duct was found very promising and delivers a turbulent sulphur cloud. The machine itself however is too heavy for manual transport. Arrangements for the fitting of a similar duct on existing dusting machines were made for trial in the 1951 season.

The fungus

The life history of *Oidium heveae* was studied and it was again found that the fungus did not hibernate but multiplied normally in low concentration throughout the year on late shoots, seedlings etc. No perfect or resting stage of the fungus is necessary for its carry-over from season to season. Promising initial results were obtained in the culture of this powdery mildew on artificial media. There are yet several difficulties to be overcome before it can be grown easily but this is by no means an impossibility.

It was also found that in some cases the fungus fruited from the edge of old lesions on mature leaves just at wintering. This provides another source of infection in the early refoilation period.

A survey of species of oidium occurring on other plants in the rubber areas showed that except in the case of *Euphorbia pilulifera* they were in no case *Oidium heveae*.

Preliminary trials to induce the formation of the yet undiscovered perfect stage of *Oidium heveae* were commenced. An examination of the massive literature on oidium was made with a view to determining possible relationship with the

known perfect stages of this indeterminate group. From the morphological evidence available it is thought that *Oidium heveae* is probably the imperfect stage of a species of the perfect genus *Erysiphe*.

The *Oidium* Season

The season in most of the rubber growing districts was particularly severe. At Dartonfield wintering of the various clones commenced in January. The earliest clones to winter were TJ. 1 and W. 259 both of which commenced on 2.1.50. The latest clones to winter were PB. 25 (27.1.50) and RRIM. 520 (26.1.50). In general this was reflected in the severity of attack by oidium of the later wintering clones at refoliation after the build up of the infection on the earlier wintering ones. Wintering time is not only a characteristic of the clone itself but is largely influenced by aspect and soil moisture and varies from year to year for each clone.

As usual, seedling rubber fields wintered very irregularly resulting in heavy incidence of oidium on the later wintering trees.

Refoliation was complete in clone W. 259 on 26.2.50 and in TJ. 1 on 8.2.50. The latest clone to refoliate was PB. 6.9 and this was the clone most severely affected by *Oidium*. The time of wintering and time of refoliation are not a constant period apart amongst the various clones. Thus a late winterer may still be a fairly early refoliator due to quick leaf development. This is important from the point of view of *Oidium* incidence.

SOILS DEPARTMENT

Report of the Soils Chemist

(By C. A. DE SILVA)

The writer handed over the work of this department in January 1950 to the Director Dr. Phillis, who attended to the correspondence in connexion with advisory work and supervised the field experiments. The Soils Laboratory was closed down temporarily during the year under review.

The data available from three experiments are summarized and commented on by the writer in the absence of the Director, who resigned his post in February, 1951.

Experiment on Manuring of Young Budded Rubber, Dartonfield, 1938

This N P, K experiment was started in 1938. The growth and yield figures for 1950 are summarized in Tables I and II. Tapping commenced in March, 1944 and the trees are in the 7th year of tapping. Girth measurements were taken in June, 1950.

TABLE I
Mean Girth in Inches

	o	n	p	k	np	nk	pk	npk	Mean
1950	24.51	24.85	27.07	23.56	27.54	26.01	27.03	27.65	26.03
1949	23.65	23.93	26.08	22.70	26.63	25.09	26.21	26.61	25.11
Increase 1949/50	0.86	0.92	0.99	0.86	0.91	0.92	0.82	1.04	0.92

The rate of growth is satisfactory for trees in their sixth year of tapping.

The total response expressed factorially for 1950 is as follows:—

		Mean	N	P	K	Sign. response (.05)
Girth 1950	..	26.03	+0.97	+2.59	+0.07	±1.00
Increase 1949/50	..	0.92	+0.06	+0.05	+0.01	—

The better grown trees are still in the phosphate plots. This advantage in growth has been carried on from year to year, due to better growth in the phosphate plots during the early years prior to the commencement of tapping. The growth rates in 1949/50 show no differences of any practical importance.

The yield figures for 1950 based on one sample tapping per month are summarized in table II, together with the total response to N, P, and K treated factorially in 1949 and 1950. The yield of one plot in the NPK treatment lost by fire has been calculated by the missing plot technique.

TABLE II
Yield in grams per tree per tapping

o	n	p	k	np	nk	pk	npk	Mean	Sign. diff.
28.5	26.2	32.1	23.5	28.4	29.2	27.5	28.2	28.0	not sig.

Total Response

	N	P	K	Sign. response (.05) (.01)
1949	+1.23	+6.18	—2.33	±3.76 ±5.04
1950	+0.07	+2.18	—1.70	not significant

It is interesting to note that the total phosphate effect which has been maintained at a significant level during the past six years of tapping does not receive the necessary statistical support in 1950. The light indication of a nitrogen effect in 1949 has disappeared in 1950.

1936 Replanted Area, 9½ Acres, Nitrogen level Experiment

This experiment has three treatments with nine replications. The treatment consist of a control and nitrogen at two levels; thirty lbs. per acre and sixty lbs. per acre per year as sulphate of ammonia.

Manuring according to experimental requirements was carried out in September 1948, April 1949 and March, 1950.

Yield results based on one sample tapping per month on S/2, d/2, 100% are summarized in Table III.

TABLE III
Yield in grams per tree per tapping

		Control	30 lbs. Nitrogen	60 lbs. Nitrogen
Preliminary year, 1948	..	21.8	22.1	23.1
Experimental years				
1949	..	26.7	27.5	21.8
1950	..	21.9	22.4	21.8

The general levels of yields in 1950 are lower than those for 1949. There is no indication of any marked differential response to the manuring treatments.

1941 Replanted Area, 6½ acres, Dartonfield—Placement of Fertilisers

In this experiment R400 (NPK) mixture was applied by four methods as follows:—

1. Broadcast
2. Forked in
3. Placed in pockets
4. Potash and Phosphate placed in pockets Nitrogen as Sulphate of Ammonia broadcast.

There are six replications of each treatment with eighteen tree plots. Manuring according to experimental requirements was carried out in September 1948, May 1949 and March, 1950. The results are shown in Table IV.

TABLE IV
Yield in grams per tree per tapping
One Sample tapping per month on S/2, d/2, 100%

Treatments		1	2	3	4
Yield 1949	..	26.8	28.2	26.8	27.8
„ 1950	..	25.4	26.9	25.0	26.5

The differences again in 1950 are not of any practical importance.

ESTATE DEPARTMENT

Report of the Estate Superintendent

(By G. W. D. BARNET)

Superintendent

Dr. E. Phillis continued to act as Estate Superintendent for 1950.

Mr. L. Wijegoonewardene, Assistant Estate Superintendent, resigned at the end of February and Mr. H. M. Buultjens, Conductor-in-Charge, Nivitigalakele Estate, acted as Assistant Estate Superintendent for the rest of the year.

The writer assumed duties as Superintendent in February 1951. This report is prepared from the data available to him.

DARTONFIELD ESTATE

Acreage Statement

(at 31.12.50)

			A.	R.	P.
Rubber Mature Seedling Areas	..	..	65	2	21
Rubber Replanted Areas	..	..	88	0	01
Nurseries	..	..	2	0	00
Buildings & Roads	..	..	18	1	36
Scrubs etc.	..	..	2	2	19
Acquired land	..	..	2	1	22
Total	..	..	179	0	19

Elevation—215 ft.

Rainfall—Total rainfall 120.12 inches.

Although the rainfall was below average and the lowest recorded for the past ten years the number of wet days was 221 days as compared with 215 days in 1949. Heaviest rainfall recorded was in October, *i.e.* 26.88 inches distributed over 23 days.

Rainfall figures for 1948-50 are shown below :

		1948 ins.	1949 ins.	1950 ins.	5 years' average 1946—50 ins.
January	.. ..	7.21	6.48	2.05	5.97
February	.. ..	5.65	0.38	5.77	5.13
March	.. ..	11.52	5.87	9.51	10.45
April	.. ..	13.55	19.58	11.40	14.39
May	.. ..	17.97	18.73	16.38	14.89
June	.. ..	24.12	16.29	9.48	17.68
July	.. ..	6.00	12.37	9.31	9.71
August	.. ..	9.19	23.81	8.36	16.04
September	.. ..	14.94	10.97	11.30	12.34
October	.. ..	22.25	24.73	26.88	24.18
November	.. ..	19.71	13.38	7.14	13.18
December	.. ..	10.22	6.44	2.54	10.53
Total	.. ..	162.33	159.03	120.12	154.49

Crop

The decline in the crop was due to the replanting programme and to the fact that slaughter tapping was being done in Field No. 3 (24 acres) earmarked for 1950 replanting. A change of policy was made and field No. 1 (28½ acres), not slaughter-tapped and earmarked for slaughter tapping in 1950 for replanting during 1951, was felled at the commencement of the year and replanted instead.

Comparative yield records of individual fields

Field No.	Date of planting	Acreage	Yield (in lbs.)		Yield per acre (lbs.)	
			1949	1950	1949	1950
1	1910	28½	16,340		573	
2	1913	1	745		745	
3	1917	24	18,268		762	
4	1911	1¼	1,016		812	
5	1934	7¾	5,024	6,059	669	807.87
6	1913	46½	29,737*	30,311	639	—
7	1936	9¼	7,799	7,388	821	798.70
8	1938	16¼	11,473	11,403	706	600.16
9	1939	1½	1,238	1,158	825	579.00
10	1941	6½	1,865	3,107	286	478.00
			93,505	59,426		

*Inclusive of Fields Nos. 1 to 4. The correct acreage cannot be mentioned as acreages under tapping in these fields varied during the year.

Tapping

Tapping was stopped on 1st January for resting during refoliation and resumed on 3rd March. During this period marking and changing-over of tapping cuts both in mature seedling areas and budded areas were effected. An additional 45 trees (from field No. 8, 2 trees ; No. 9, 14 trees ; and No. 10, 29 trees) were taken into tapping during the year under review. Number of days tapped was 248.

			Expt. Budded Areas S/2, d/2 (without Sundays)	
1st Quarter	..	..	..	9.66
2nd „	..	..	..	17.02
3rd „	..	..	..	19.75
4th „	..	..	..	15.89

N.B.—The tapping averages of Fields Nos. 1 to 5 are not given on account of the different systems of tapping being adopted at various times of the year and owing to the fact that the number of tappers employed and the number of trees tapped was not the same throughout.

Analysis of tapping rounds for 1950 (1949 figures in brackets)

	Winter- ing	Early tapping	Late tapping	Very late tapping	Wash- outs	Partial washouts	No tapping	
							Rain	H'days
1st Qr.	28(24)	49(58)	—(3)	—(—)	—(—)	—(—)	—(—)	2(13)
2nd Qr.	—(—)	41(45)	16(8)	7(6)	—(—)	—(—)	9(14)	5(18)
3rd Qr.	—(—)	43(41)	25(15)	7(7)	—(—)	—(—)	11(15)	—(14)
4th Qr.	—(—)	56(64)	11(5)	—(2)	—(—)	—(—)	8(5)	3(16)

Manufacture

A summary of the grades prepared during the year

				Total (lbs.)	Percentage of grades
Smoked Sheet	No. 1	..	..	5,451	9.17
do.	No. 2	..	..	2,623	4.41
do.	No. 3	..	..	466	.79
Latex Crepe	No. 1	..	..	22,042	37.09
do.	Nos. 2 & 3	..	..	13,525	22.76
Scrap Crepe	No. 1	..	..	9,160	15.14
do.	No. 2	..	..	605	1.02
do.	No. 3	..	..	224	0.38
M. B. T.	..	..	..	396	0.67
Creamed Latex	..	..	..	4,934	8.30
				59,426	100.00

Factory

The inside and outside of this Building was whitewashed and the portions of guttering which were perforated were renewed.

Machinery

The Consulting Engineers Messrs. Hammond & Co. inspected the machinery and electrical equipment in March.

Power Plant

- (a) 80/90 B.H.P. National Oil Engine worked satisfactorily. In good order.
- (b) 55 K.W. 230 Volt compound Wound Generator driven by the above engine worked satisfactorily. In good order.
- (c) 52 B.H.P. Vertical Ruston Engine was dismantled and cleaned.
- (d) 32 K.W. 230/240 Volt compound Wound Generator coupled direct to the above Engine worked satisfactorily. In good order.
- (e) 20 B.H.P. Gardner Oil Engine (Cold Start) worked satisfactorily. In good order.
- (f) 12 K.W. 230 Volt Generator "V" belt driven by the above Engine worked satisfactorily. In good order.
- (g) Air Compressor driven by a 2 H.P. Motor worked satisfactorily. In good order.
- (h) 6 N.H.P. Vertical Cross Tube Boiler. A new hand pump was installed for this Boiler as when working with low pressures the injector does not function (the injector does not come into operation until pressure reaches 50 lb. per sq. inch).

The Electrical wiring in the Factory was completely renewed to the satisfaction of the Consulting Engineer.

Machinery in Factory

- (a) 26" Water cooled Grooved mill driven by 25 H.P. Electric Motor. The mill and the motor are both in order and working satisfactorily.
- (b) 26" Water cooled Smooth Mill driven by 25 H.P. Electric Motor. The bearing blocks in this Mill were rebushed. A new roll should be ordered to replace mild steel front roll installed as a temporary measure with a proper soft iron roll.
- (c) 24" Smooth Sheeting Mill driven by a 1½ H.P. Electric Motor. All the bearing blocks on this mill require rebushing. The motor is in order.

- (d) **24" Spiral Sheetting Mill driven by a 1½ H.P. Electric Motor.** This mill is in order but the field windings of the motor are faulty and have to be re-wound.
- (e) **2—12" Crepe Mills (1 Smooth & 1 Grooved) driven by a 5 H.P. Electric Motor.** These Mills and the motor are in order.
- (f) **30' Hydro-Extractor driven by a 4 H.P. Electric Motor.** Both these are in order.
- (g) **High Speed Disintegrator driven by a 3 H.P. Electric Motor** was out of commission. This will be put in working order prior to the arrival of the Chemist.
- (h) **Centrifugal Separator driven by a ½ H.P. Motor.** Both these are in order.
- (i) **Air Compressor**—out of commission at present.
- (j) **Latex Evaporator**—out of commission at present.
- (k) **Baling Press.** In order.
- (l) **Water Filter.** In order.
- (m) **Ball mill driven by a 1 H.P. Electric Motor.** Out of commission at present.
- (n) **Colloid Mill driven by a ½ H.P. Electric Motor.** Out of commission at present.
- (o) **Vacuum Drier & Steam Pump.** Out of commission at present.
- (p) **Steam Vulcanizing Press (hand worked).** Out of commission at present.
- (q) **Automatic Sprinkler at Smoke House.** In order. The alarm bell is also functioning satisfactorily.

Pumps

- (a) **4"×5" Double Acting Horizontal Pump** by Myers driven by a 5 H.P. electric motor situated by the old well. The pump and motor are in order
- (b) **Double Acting Horizontal Pump** by Walker & Grieg Ltd. driven by a 2 H.P. motor and situated by the new well was becoming unserviceable ; so a new 4"×5" Myer's Pump with a 5 H.P. electric motor was ordered and will be fitted on in 1951.
- (c) **Centrifugal Pump** driven by a 4.5 H.P. electric motor and situated by the Storage Tank. The pump and motor are in order.
- (d) **4"×3" Horizontal Double Acting Pump** by Lee Howl driven by a 5 H.P. motor and situated by the Storage Tank—In order.

Fuel Consumption

Details of fuel consumption for the period January—December are given below:

				Average per hour
National Engine—90 H.P.				
Diesel Oil	..	..	..	1.76 gls.
Lubricating oil	..	..	..	0.13 „
Gardner Engine—20 H.P.				
Diesel Oil	..	..	..	0.75 gls.
Lubricating oil	..	..	..	0.09 „

Ruston Engine ran only for 2½ hrs. (on test) during the year and consumed 2 gls. Diesolene and 0.20 gls. Lubricating oil per hour.

Pests and Diseases

Oidium. Incidence of Oidium was very severe. Sulphur dusting was carried out in the budded areas in accordance with the instructions given by the Oidium Research Officer.

Phytophthora—Leaf fall. Incidence of Phytophthora secondary leaf fall was negligible.

Fomes lignosus. In the mature seedling Rubber (Field No. 6) a new patch was observed and routine control measures were implemented.

In the 1947 Replanted area eight new patches were observed and control measures were adopted under the supervision of the Mycology Department. A tree to tree inspection was made in May and altogether ninety five Fomes infected trees were uprooted.

Brown Bast. 53 trees in the budded areas were treated for Brown Bast.

Disinfectants. Application of 10 per cent Brunolinum Plantarium and Cargillineum B were made to tapping cuts during wet and dry weather respectively.

Loss of Trees. Trees uprooted during the year were as follows:

27	trees from commercial areas due to Fomes.
95	„ „ 1947 Replanted Area due to Fomes.
88	„ „ commercial areas for establishing nurseries.

Manuring

Replanted Areas Nos. 2 (1938), 3 (1936), 5 (1941), and 6 (1947) were manured on an experimental basis.

1950 Replanting was manured with Black Label mixture and Mineral Phosphates.

Weeding

Weeding of budded areas, 1947 Replanted Area and 1950 Replanted was carried out satisfactorily.

Attention was given to the control of natural covers; and indigenous erect covers and self sown rubber seedlings were weeded.

1950 Replanting

Felling for 1950 replanting commenced at the end of December 1949 and 33 acres completed in April 1950.

3,050 holes were cut in May/June and 2,850 holes were planted with clones derived from the 1945 hand pollinated seedlings. As the balance 200 holes were subject to Fomes, supplies were planted in trenches outside the patches to be transferred later to the holes after a thorough cleaning-up.

Roads, Paths, etc.

Estate roads and paths were maintained in reasonably good condition. Colas were applied on a portion of the road.

Verification of Stores

This was done in the usual manner.

Buildings

Renovation of all buildings (re-guttering, rewiring, repainting and white-washing etc.) was taken in hand; and at the end of the year only a few Junior Staff Bungalows remained to be done.

One new servants' latrine for Senior Staff Bungalow No. 1 was made.

Water Supply

Junior Staff Bungalow water-storage tanks were cleaned and the old wooden-framed wire net covers were replaced by new ones. Before water-borne sanitation is installed in these bungalows the water supply will have to be augmented. Estimates are being prepared for this.

The pipe line to the Engine Driver's Quarters was found to be defective and new piping were laid.

A wash-out pipe was installed at the dam which supplies water to the factory. All the wells were renovated.

Labour

(a) Wage increases were effected in accordance with Government notifications as under:

		January to May to November onward.		
		cts.	cts.	cts.
Males over 16 years	..	0.58	0.75	1.10
Females over 15 years	..	0.46	0.60	1.00
Children	..	0.41	0.50	0.75

Labour was sufficient and settled. Details of labour on checkroll at the end of the year were as follows:

Non-Ceylonese		Resident	Non-resident	Total
Men	..	24	—	24
Women	..	21	—	21
Children	..	2	—	2
Ceylonese	..	14	77	91
		61	77	138

Health

The health of the labour and staff of the Rubber Research Scheme has been satisfactory during the year 1950.

Infectious Diseases. There were 6 cases, *i.e.* 3 measles and 3 mumps. These cases were isolated and treated.

Deaths. During the year, there has not been a single death amongst the labourers and their children on Dartonfield and the other Estates of the Rubber Research Scheme.

Hookworm. Treatment of this disease was carried out according to Dr. MacDonald's recommendations of the Estate Health Scheme with very good results.

B.C.G. Campaign officers of the Government Medical Department visited Dartonfield and carried out work in this connection.

The following is a list of the diseases treated among the labourers and staff during the year:—

Influenza	..	..	..	47
Malaria	..	..	..	22
Ulcer	..	..	..	45
Anchylostoma	..	..	..	86
Worms	..	..	..	36
Other diseases	..	..	..	478
				714

Annual Holidays

Holiday pay was given to all labourers entitled to holidays in accordance with the Wages Board Ordinance.

Maternity Benefits

One ordinary and two alternative payments were made under the Maternity Benefits Ordinance.

Nurseries

Two nurseries were established during the year. A budwood nursery with 200 budged stumps of clone LCB. 870 was established. The Seedling Nursery was planted with germinated seedlings obtained from Ellakande Estate for a stock nursery for 1952 Clearings.

NIVITIGALAKELE ESTATE

Acreage Statement

			A.	R.	P.	A.	R.	P.
Rubber in tapping	..	..	102	0	22			
Rubber not in tapping	..	..	32	3	13	134	3	35
Seedling Nurseries	..	..	7	1	37			
Budwood do.	..	..	6	2	04			
Buildings & Roads	..	..	2	0	15			
Uncultivated	..	..	21	0	23	37	0	39
Total	..	..				172	0	34

Rainfall—87.94 inches.

No. of wet days 171

The rainfall for the year was below average, and the lowest recorded for the past ten years.

Crop—The crop secured for the year was 72,239 lbs. which is 106.6% of the estimated crop 67,780 lbs. and is 4,311 lbs. above that of 1949.

Comparative yield records are given below for the year:

Clearings	Acres	Crop in lbs.		Yield per acre	
		1949	1950	1949	1950
1926	.. 12½	12,142	10,942	883	875
1927	.. 10	8,856	8,049	824	804
1928	.. 15¾	12,623	11,751	801	746
1935	.. 28½	18,111	19,154	635	672
1939	.. 10¼	6,151	7,499	600	731
1940	.. 9¾	4,744	6,974	486	715
1941	.. 7	3,550	5,148	507	735
1942	.. 5	876	1,566	175	313
Swamp Area	.. 3½	875	1,156	269	355

Tapping was stopped on 4th February for resting during refoliation and resumed on 1st March. Tapping cuts were changed where necessary.

The following trees were taken into tapping during the year:

1939	Clearing	..	..	1
1940	"	..	..	1
1941	"	..	..	5
				—
				7
				—

Analysis of tapping rounds for 1950 (1949 figures in brackets)

		Early tapping	Late tapping	Very late tapping	Wash- outs	Partial washouts	No tapping Rain	Holidays
1st Qrt.	..	51(70)	3(5)	—(—)	—(—)	—(—)	—(—)	11(15)
2nd Qrt.	..	37(44)	23(6)	—(—)	—(2)	4(—)	9(23)	18(18)
3rd Qrt.	..	41(46)	24(17)	—(—)	—(1)	—(—)	14(16)	13(13)
4th Qrt.	..	51(52)	17(20)	—(—)	—(—)	—(—)	7(5)	17(15)

Manufacture

Rubber coagulum was daily transported to Dartonfield factory for manufacture into crepe. The distribution of grades is given below:

		1st Qrt.	2nd Qrt.	3rd Qrt.	4th Qrt.	Total	%
Pale Crepe	No. 1	6,150	9,446	9,310	3,995	28,911	40.02
do.	No. 2	2,462	1,952	1,464	396	6,274	8.69
do.	No. 3	19,68	2,927	3,117	1,745	9,757	13.51
Scrap Crepe	No. 1	1,630	2,555	3,082	3,564	10,831	14.99
do.	No. 2	201	214	447	115	977	1.35
do.	No. 3	321	448	—	—	769	1.06
Smoke Sheets	No. 1	—	—	—	224	224	.31
do.	No. 2	—	—	560	1,209	1,769	2.45
do.	No. 3	—	—	784	751	1,535	2.12
Sole Crepe		—	—	740	320	1,060	1.47
Creamed Latex		—	—	—	10,132	10,132	14.03
		12,742	17,542	19,504	22,451	72,239	100.00

Machinery

5 H.P. National Engine was maintained in good order.

Pests and Diseases

Bark rot & Canker—A number of trees were affected by bark rot and canker. Canker scraping was carried out, and disinfectants were applied.

Ustulina zonata—A number of cases of *Ustulina zonata* were detected during the year. Some trees were uprooted while others received treatment.

Brown Bast—Six trees which were badly affected by brown bast were uprooted and control measures were adopted in other cases of the disease.

Application of Brunolinum Plantarium and Cargillinium B were made to tapping cuts by tappers during wet and dry weather respectively.

Trees lost from various causes were as follows:

Brown Bast	..	..	6 trees
Brown Root	..	..	4 "
Wind damage	..	..	10 "
Ustulina zonata	..	..	17 "
			—
			37
			—

249 trees were uprooted by the Tea Research Institute to layout a nursery. These trees were from 1926 and 1937 Clearings.

Manuring—No Manuring was done during the year in the new clearings or in mature rubber areas.

Weeding—Weeding was completed in all the clearings.

Nurseries

Work in connection with these nurseries was done on instructions received from the Botanical Department.

All dead stocks in the budwood nursery were uprooted for supplying with fresh material. A large number of buddings were done (some with material from Malaya) and the results were good. Material from these will be made available for propagation.

Seedlings budded with clones no longer required were discarded from the nursery. Approximately 46,900 seedlings were planted by germinating seed obtained from Mirishena, Govinna, Ellakande and Nivitigalakele. Nurseries were periodically manured and every attention was paid where upkeep works were concerned.

The demand for budwood and clonal seedlings as compared with previous year was exceptionally high especially for budwood of clones NAB. 20 and LCB. 870.

Roads and Paths

Surface repairs to the approach road were done. All minor estate roads and paths were maintained reasonably well throughout the year.

Buildings

All bungalows, minor buildings and lines were properly maintained.

Labour

Labour was sufficient and settled. Health of the labourers was moderately good. Details of labour on checkroll at the end of the year were as under:

Ceylonese		Resident	Non-Resident	Total
Ceylonese	..	.. 23	33	56
Non-Ceylonese	..	.. 3	—	3
		—	—	—
		26	33	59
		—	—	—

HEDIGALLA ESTATE

Acreege Statement

New Clearings		Acres	
1943	..	..	11
1944	..	..	14
1945	..	..	25
1946	..	..	16
1947	..	..	60
1949	..	..	30
1950	..	..	20
Total		..	176

These figures are approximate as no survey of the fields has been made to date.

Rainfall—131.47 inches.

No. of wet days .. 214

The rainfall for the year was 50 inches below that of 1949. The highest rainfall recorded was in October, *i.e.* 25 inches. A fair amount of rain fell between April and September too.

1943 Clearing

This clearing has 1,122 trees out of which 1,049 were taken into tapping on 16th August. Two tappers were employed daily and at the end of the year 1,019 lbs. latex and 181 lbs. scrap were collected. Coagulum and scrap were sent weekly to Darton-field for manufacture.

The whole area was manured with R215 at $\frac{1}{2}$ lb. per tree. Canker scraping was carried out where needed and applications of disinfectants done.

1944 Clearing

Girth measurements of all trees were taken as this clearing is due for tapping in early 1951. R215 manure was applied at $\frac{1}{2}$ lb. per tree.

1945 Clearing

Inspection paths were opened, and girth measurements of trees taken in the large-scale-clone-trial. Application of R215 manure at $\frac{1}{2}$ lb. per tree was done in September.

All unsuccessful buddings were uprooted in the crown budding area.

1946 Clearing

87 trees of this area was manured with saphos phosphate in January and the rest in October with "black label" manure at $\frac{1}{2}$ lb. per tree.

1947 Clearing

Manuring of this clearing was completed in October, the manure used being saphos phosphate, R214 and "black label" animal meal. Budding operations were conducted on this clearing in September under the supervision of the Mycology Department.

1949 Clearing

Logs were arranged against the contours in the whole area to check soil erosion. Inspection paths were cleared and all the vacant holes were supplied with plants from the nurseries.

In November application of "black label" Animal Meal manure at 4 ozs. per plant was completed.

1950 Clearing

Felling on this clearing commenced in January and completed in October. Planting was started in October and 8 foreign clones—Chemara 2, 3, 4, 8, 26, 29, 31 and 32 were used with clones LCB. 870 and PB. 86 as controls. The clones are randomized in 3 blocks making up a total number of 750 planted holes. Planting was not complete at the end of the year owing to unsuitable weather conditions.

Pests and Diseases

A mild attack of Oidium was noticed in the 1943 and 1944 clearings and 2 rounds of sulphur dusting was carried out.

Buildings—Minor repairs were effected during the year.

Cart Road—The extension of the cart road to the 1950 clearing was started in December by employing Estate labour. This work was not completed by the end of the year and will be continued in 1951.

Food Production in the Estates

Nivitigalakele	..	$\frac{1}{2}$ acre paddy
Hedigalla	..	Pine apples.

Crop harvested

Paddy	..	101 measures
Pine apples	..	6,209

A sum of Rs. 931/35 was realized from sale of pine apples as against an expenditure of Rs. 79/79 for planting and harvesting. This amount was credited to the Scheme's revenue.

Visiting Adviser—The practice of obtaining a report on the condition of the estates was dispensed with during the year under review.

SMALLHOLDINGS DEPARTMENT

Report of the Smallholdings Propaganda Officer

(By W. I. PIERIS)

THE year has been an exceptionally prosperous one for the Rubber Industry with the price of rubber rising steadily from about 75 cents per pound of smoked sheet at the beginning of the year to over Rs. 3/- in November. The Rubber smallholder with the rest of the Rubber planting industry responded to this situation as might be expected by a general increase in activity both in the planting and production of rubber, with the result that the advisory services of the Department were kept unusually busy throughout the year.

Staff

The numerical strength of the staff remained more or less the same as in 1949, namely one Smallholdings Propaganda Officer (the writer), three Asst. Propaganda Officers, four District Field Officers, thirty-one Rubber Instructors, four clerks and two peons. The fifth clerk who was in the Head Office at Dartonfield left in January but no re-appointment was made. One District Field Officer and three Rubber Instructors left the Department or were given notice. One Rubber Instructor and one Accounts Clerk were appointed to fill vacancies, while four vacant posts (Rubber Instructors) remained to be filled at the end of the year. Mr. P. S. G. Cooray, Rubber Instructor Talgaswala, was promoted as District Field Officer Horana in October on the resignation of Mr. K. B. Angunawala from this office. Nine Rubber Instructors were transferred to different ranges in November where, for various reasons, it was thought they would be able to do better work. Loans for the purchase of motor vehicles were given by the Board to one District Field Officer and three Rubber Instructors.

Survey of N.R.P.S. Holdings

The work of census-taking of N.R.P.S. permit-areas which was begun by Rubber Instructors in 1949 for the purpose of ascertaining existing conditions of new-planted holdings was completed in March with 1,461 additional visits. The summarizing of the data appearing in the 18,654 individual census forms filled, which would otherwise have involved extensive clerical work, was distributed among the field staff who were allowed to devote one or two days to it each week. The results of this analysis which was begun in the middle of September and concluded by the end of October were briefly as follows:

Out of a total of 20,845 new-planted holdings visited by Instructors for the survey, returns were filled in respect of 18,654, the remaining 2,191 being found totally neglected and their permits cancelled by the Rubber Controller. The 18,654 permit areas "surveyed" consisted of 8,081 middle-class ones comprising 31,570 acres, 9,995 peasant-class ones comprising 15,247 acres and 578 colony permits (also peasant-class) comprising 876 acres. Of the 31,570 acres middle-class, the 15,247 acres peasant-class and the 876 acres colony, 25,853 acres, 12,424 acres and 698 acres respectively were found planted, the balance 8,718 acres consisting mainly of unplanted portions of planted lands whose permits have not been cancelled by the Rubber Controller.

Of the 25,853 acres of planted middle-class holdings, 8,811 acres or 34% fell into "class 1" (*i.e.* plantations whose average tree girth indicated satisfactory growth), 8,822 acres or another 34% into "class 2" (*i.e.* those whose growth though poor was capable of improvement), 6,396 acres or 25% into "class 3" (*i.e.* those of very poor growth which are not likely to make satisfactory plantations) and 1,824 acres or 7% into "unclassified" (*i.e.* plantations of under 1½ years or in thick jungle). Similarly of the 12,424 acres of planted peasant holdings, 4,182 acres or 34% fell into class 1, 3,772 acres or 30% into class 2, 3,662 acres or 29% into class 3 and 842 acres or 7% into "unclassified" and of the 698 acres of planted colony holdings, 110 acres or 16% fell into class 1, 179 acres or 26% into class 2, 359 acres or 51% into class 3 and 50 acres or 7% into "unclassified".

These figures indicate that an unduly high proportion (51%) of colony holdings has been rendered more or less useless by neglect while a further 26% are of poor growth though possible of redemption.

The classification also showed that of the middle-class holdings, 14,951 acres (58%) were planted with budded rubber, 1,658 acres (6%) with clonal seedlings and 7,458 acres (29%) with ordinary rubber, the balance 1,825 acres (7%) being "unclassified". Similar figures for peasant holdings were 6,683 acres (54%) budded rubber, 417 acres (3%) clonal seedlings, 4,482 acres (36%) ordinary rubber and 842 acres (7%) "unclassified", and for colony holdings, 379 acres (54%) budded rubber, 84 acres (12%) clonal seedlings, 185 acres (27%) ordinary rubber and 50 acres (7%) "unclassified".

Approximately 20% of the middle-class holdings were planted on very steep land, 68% on steep land, 11% on flat and 1% on deniya land. Corresponding percentages for peasant-class holdings were 23, 67, 9 and 1% respectively and for colony holdings 41, 50, 9 and nil % respectively. Up to the date of the survey approximately 25% of the middle-class holdings, 17% of the peasant-class and 18% of the colony were tapped. While on middle-class holdings 70% of the tapping was on the ½ spiral alternate day system and 28% on the ½ spiral daily, on peasant-class and colony holdings the corresponding percentages were 46% and 52% respectively and 18 and 72% respectively, indicating severe over-tapping on over 50% of peasant and colony holdings which is likely to have fatal results. Tapping of under-girth trees was evident on 4% of middle-class, 6% of peasant-class and 16% of colony holdings tapped. Tapping wounds occurred on 4½%, 7% and 22% respectively of the above groups tapped so far. The most popular form of soil conservation measure adopted was the contour drain. All except 14% of middle-class, 13% of peasant-class and 4% of colony holdings were soil conserved, grants having been paid to all peasant-class owners.

Arising out of the very interesting information resulting from this survey is the problem as to what Government proposes to do with "class 3" holdings and whether they are ever likely to make economic plantations.

An unsolicited letter was received from Mr. E. W. Whitelaw from Scotland complimenting the Department on the work done in connection with the survey. Mr. Whitelaw, it may be recalled, as one of the two Rubber Commissioners, possesses an intimate knowledge of the New Rubber Planting Scheme to which he has referred in some detail in the Commission's Report and is in a competent position to estimate the scope of the work carried out. The writer also wishes to place on record his personal appreciation of the co-operation received and hard work put in by all ranks of the staff both in making the survey and analysing the data collected.

New Planting and Replanting

There was a considerable demand for permits for planting new land under Rubber due to the very favourable Rubber market that prevailed. 2,023 new-planting permits covering 3,478 acres were issued by the Rubber Controller to peasant and middle-class applicants during the year, after the suitability of each land for planting Rubber had been inspected and reported on by a Rubber Instructor. 2,431 such reports were sent to the Rubber Controller. 1,120 previous permits, comprising approximately 2,880 acres, were cancelled owing to the lack of interest shown by the permit-holders.

Replanting by smallholders continued to be very poor and it is unlikely that any real progress will be made in this direction unless some form of Government assistance is forthcoming. Considering the large amount of slaughter-tapped small-holding Rubber and the urgent need to replace it with modern high-yielding material, early attention should be given to this matter. As a first step it is suggested that free planting material and soil conservation grants which are presently available to peasant-class new-planters, should also be made available to replanters. As an example of Ceylon's backwardness in this respect it might be stated that whereas in Malaya 1,416 acres were replanted by smallholders of under 10 acres in 1949, only 94 acres were replanted in Ceylon.

At the request of the A.G.A. Kegalla advisory supervision of the replanting of 87 acres of the Urumiwala Colony was undertaken. Roughly one out of every two acres of Rubber belonging to each colonist is to be replanted on a Government subsidy of Rs. 150/- per acre. Work was started in October with the lining for contour holes (20 ft. $\times$ 12 ft.) by the resident overseer and the Rubber Instructor Undugoda under the supervision of the District Field Officer Kegalla. Lining was completed on 19 allotments and holing begun. Owing to the prevailing high price of rubber the felling of trees was deferred till holing was completed. To avoid making individual replanting blocks too small, two or more were taken contiguous to one another. Top soil from holes was kept separate and compost pits were prepared by each colonist. Planting with clonal seedlings (to be supplied by this Department) will be done in September 1951 and the end of the year saw satisfactory headway being made. A conference with the A.G.A. and Land Officer was held at Kegalla on September 22nd in connection with this work.

The 7 demonstration replanted blocks supervised by the Department were maintained in good order and given their annual dressing of cattle and compost manure.

In all Instructors paid 14,800 advisory visits to new-planted and 1,112 to replanted holdings. Replanting work was completed in 21 holdings (39 acres) under the direction of Rubber Instructors.

Planting Material

In anticipation of the heavy demand for planting material in 1951 arrangements were made with the Agricultural Department to put down every available clonal seed from the Walpita Seed Garden. Nurseries totalling approximately 60,000 clonal seedlings were consequently established at the Egaloya and Walpita Government Farms and supervision of their proper development (by weeding, manuring

etc.) was maintained by means of frequent visits by Rubber-Instructors. With an additional 30,000 clonal seedlings available at Nivitigalakele and Dartonfield, it is hoped that the demand for planting material for 1951, which includes 20,000 plants for the Urumiwal replanting, could be satisfactorily met.

During 1950, 13,291 clonal seedlings were issued free to peasants and 5,992 clonal seedlings and 2,657 budded plants sold to the middle-classes and replanters. Though the actual demand was in fact greater, issues were necessarily confined to the stocks available. 498 yards of budwood were issued from Nivitigalakele for budding demonstration nurseries.

Co-operative Work

Attention was given to the formation of more Rubber Co-operative Societies as a means of improving smallholders' sheet. Although the response was fairly satisfactory serious difficulties arose over the question of obtaining the initial loans required for putting up the necessary buildings and purchasing rollers and equipment. The Rubber Board was of the opinion that this was the function of the Co-operative Department but the latter maintained that it had no funds for giving capital loans of this kind even if the societies in question were 'registered' by it. The matter was thereupon re-considered by the Rubber Board who decided to allow limited loans as a trial on suitable security. The decision, however, was made too late in the year for any loans to be arranged. Nevertheless several societies have, on their own initiative and under the guidance of this Department, succeeded in collecting varying sums of money with some difficulty and put up smokehouses and curing sheds and purchased rollers, while a few notably the Dapiligoda Society at Agalawatta and the Ittapana Society at Matugama, have actually reached the final stage of co-operative sheet manufacture by bulking members' latex. Partial progress in building co-operative smokehouses and curing sheds and in purchasing rollers has also been made by the Kahagalla and Bodawela Societies at Kegalla, Dawalhabe Society Warakapola, the Dediyaigala and Maliduwa Societies at Akuressa and the Aruppola Society Nelundeniya. Each of these Societies was given considerable assistance by this Department in designing and supervising their buildings and in procuring good rollers from Colombo, but in most cases progress has been slow owing to the difficulty of funds.

Although the field staff is making every effort to improve the quality of smallholders' rubber by means of individual visits, demonstrations and advice, it must be realised that any substantial improvement would only be possible through the furtherance of co-operative effort and as such the provision of loans to get co-operative units started should be considered not only as an essential obligation on the part of the authorities concerned but as one that would be amply repaid.

The Hataraliyadda Society started in 1942 by this Department, which was the first experimental co-operative sheet-making enterprise of this kind paid its final instalment of Rs. 509/05 in full repayment of the loan of Rs. 3,000/-. This Society has been a great success and presents an excellent example of the benefits of co-operative principles as applied to Rubber smallholders. The Director Rubber Reserach Scheme visited the Society in March and commended the high standard of work that was being maintained.

Sheet Improvement

799 sheet-making demonstrations were given by Instructors to individuals or groups of smallholders and 1,016 visits paid to Government Rubber Depots for the purpose of introducing small-holders who make good sheet and getting favourable prices for their rubber. A few complaints were received that Depots were not paying the best prices for sheet but on reference to the Rubber Commissioner it was ascertained that on a rising market the Depots were unable to compete with private dealers who often paid speculative prices. Under these circumstances smallholders were advised to sell to the buyer who paid the best price.

1,013 sq. ft. of brass mesh @ Rs. 1/20 per sq. foot and 227 bottles (one-seventh gallon capacity) of 80% D.C.I. Acetic acid @ Rs. 1/35 per bottle were sold to smallholders through Rubber Instructors. The latter is purchased in carboys from the Department of Industries and bottled, sealed, labelled and sold at costprice to supply the demand for small quantities of reliable acid particularly from smallholders in remote areas who are often at the mercy of unscrupulous dealers for their stocks. The printed label on the bottle indicates in Sinhalese the price, strength and dose of acid to be used for coagulating a standard 1½ lb. sheet. Bottling was started in June and only small quantities could be dealt with by the staff owing to their other duties.

38 “Quality Certificates” were issued since June to smallholders who consistently made good sheet under the directions of this Department and 227 dombawood latex pans were made for similar free issue. Moulds were made and a compound cement latex trough of 12-sheet capacity was produced at Dartonfield under the Director’s supervision for trial by smallholders as a possible means of economising on individual pans. A sufficiently inexpensive material for the partitions has yet to be found as aluminium is too expensive for smallholders.

63 demonstration and 243 private smokehouses of simple standard design and mud construction were started during the year under Instructors’ supervision and 62 demonstration and 142 private houses were completed. 197 existing houses were improved. 9,546 advisory visits to smokehouses were also made by Instructors.

Soil Conservation

A total sum of Rs. 5,191/12 was paid out to 75 peasant-class new-planting permit-holders as grants for soil conservation during the year. Each holding was inspected and all work carefully measured before payment. Payments on this account are gradually diminishing as most of the 1938/1942 N.R.P.S. permit-areas have now been soil conserved and paid for. New permits issued in 1949/1950, however, remain to be conserved.

676 acres in 531 new-planting holdings were contour-lined by Instructors for soil conservation, in addition to 67 acres in 33 mature holdings and 89 acres in 59 replanting holdings. There was a heavy demand for lining by L.D.O. rubber allottees in the Migahatenna area at the end of the year and the local Rubber Instructor who was unable to cope with the work was supplemented by an extra officer from another range for a short time.

Dr. R. M. Gorrie, the new Soil Conservation Officer of the Department of Agriculture, was shown round some of the soil conservation work on Rubber holdings in the Kalutara District in May and he was favourably impressed with the work done. A batch of five field officers attended a 10-day lecture course by Dr. Gorrie at Peradeniya in July.

Rubber Colonies

The A.G.A. Kalutara was interviewed in March regarding the share of responsibility attached to this Department over the supervision of the various Rubber colonies under his charge. It was explained to him that the recent survey revealed a high proportion of “grade 3” plantations in the colonies. It was decided that Rubber Instructors should continue to visit colonies and give advice as before, preferably in the company of the A.G.A.’s Colonization Officers, but that their recommendations should also be communicated by the writer to the A.G.A. so that he could get his Colonization Officers to see that they were carried out. These decisions were confirmed in writing and duly carried out and a number of inspection reports, giving details of individual colonists who did bad work, were forwarded to the A.G.A. in respect of the Midalana, Morapitiya, Pelawatte, Divalakada, Ambagoda and Molkawa colonies. No material improvement in the status quo of the colonies,

however, was effected mainly due to the inability of Colonization Officers to get colonists to follow their instructions. The A.G.A. has since suggested that all supervisory work in the colonies should be taken over by this Department, including the lining and measurement of soil conservation work, checking of planting holes and the supervision of general maintenance, which have hitherto been done by his own staff but no final decision has been made.

Visits, Demonstrations, Compost-Pits

In addition to the sheet-making demonstration already mentioned, 580 tapping, 122 disease control, 37 budding and 354 other demonstrations were given by Ins-tructors. They also paid 6,346 advisory visits to mature holdings besides those made to new-planting and replanting holdings. 160 demonstrations and 68 private compost-pits were opened.

Correspondence

General	..	..	Inward	2,808
			Outward	2,405
With Rubber Controller	..	..	Inward	4,812
			Outward	3,919

General

The Director was shown round a number of ranges in the northern sector, the Urumiwela Rubber Allotments, the Hataraliyadda Rubber Co-operative Society and the Walpita Rubber nurseries in March. The various types of service rendered to smallholders and their problems were shown and explained to him at first hand, thereby enabling him to form an accurate estimate of the work done by the Depart-ment.

ADVISORY SERVICES ETC.

During the year about 1,128 advisory letters were written by the Head Quarter's Staff in addition to verbal enquiries attended to. This correspondence was nearly 60% greater than that of 1948. Smallholdings Department correspondence is re-ferred to in the relevant departmental report.

Most of the enquiries received were on the following subjects:—

1. Manuring
2. Planting Material
3. Tapping
4. Oidium and Sulphur Dusting
5. Pests and Diseases
6. Poisoning of rubber trees
7. Weed killers
8. Cover crops
9. Smoke houses and Factory designs
10. Precoagulation
11. D.R.C. of latex
12. Discolouration of Crepe
13. Defects in Crepe and Smoked Sheet
14. Coagulants & Anti-coagulants
15. Seed Gardens

Cocoa and Specification Rubber were two new items upon which a number of enquiries were made.

Advisory visits to estates were made during the year by members of the Senior Scientific Staff.

Demonstrations

A well attended field day was held at Kepitigalla Estate on 1.4.50 at the Scheme's Clone Museum where Oidium control was discussed by the Oidium Research Officer and a demonstration of mist blowing of fungicides was given. The visitors also inspected the clone museum and resistant clone LCB. 870.

A topical exhibit was staged at the Science Exhibiton in Colombo on November 30th to 1st December 1950. This attracted considerable attention.

Meetings, Committees, etc.

The Director attended all meetings of the Board of Management and served on the Experimental Committee. He also attended a number of Planters' Associations, meetings and Central Board of Agriculture meetings, and served on the Rubber Advisory Board during the year. In August he attended the United Planters' Association of Southern India conference at Coonoor in South India.

Visitors

Visitors to the Scheme during the year included the Hon'ble the Minister for Agriculture & Lands, Mr. Dudley Senanayake and party, as well as visitors from various scientific and commercial organizations including Dr. W. F. Van Hell of Medan, Sumatra, Dr. J. H. Van Emden of Proefstation der C.P.V., Indonesia, Mr. R. A. Alston of Rubber Research Institute of Malaya, Prof. I. V. Newman of University of Ceylon, Mr. R. Fabre of French Rubber Growers' Association, Paris, Mr. Van de Velde Gerard of Belgium, and Mr. R. I. Herriot of Department of Agriculture, Adelaide.

Co-operation with other Research Institutions

The Scheme continued in close touch with the Rubber Research Institute of Malaya and with the Research Organizations in Indonesia and Indo-China. The Rubber Development Board and the Rubber Producers' Research Organisation continue to give all possible help.

There is constant communication with the London Advisory Committee for Rubber Research (Ceylon and Malaya) and it is a pleasure to record our appreciation of the speed and efficiency with which our numerous requests are dealt with.

The cordial relations existing with the Coconut Research Scheme, the Tea Research Institute and the Dept. of Agriculture in Ceylon continued.

Publications

During the year the following publications were issued:

1. Report of the Work of the Rubber Research Board in 1949.
2. Quarterly Circular Special Issue on Better Natural Rubber.
3. Advisory Circular No. 28 entitled "Oidium Leaf Disease."

The following cyclostyled memoranda were prepared and issued during the year:

1. Memo on Dartonfield Fertiliser Experiments.
2. " " Release of Malayan clones of the 500 series in Ceylon.
3. " " Fractionation of latex by partial coagulation without acid.
4. " " Quality Grading for Natural Rubber.
5. " " Postwar Agricultural Production and Processing of Natural Rubber by Dr. E. M. McCollm.
6. Memo to Superintendents of Estates with Smoked Sheet Factories.

Research Laboratories,
Dartonfield,
Agalawatta.
10-5-1951.

(Sgd.) H. E. YOUNG
Acting Director

LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH CEYLON AND MALAYA REPORT FOR 1949 AND 1950

GENERAL ADMINISTRATION

EARLY in 1949 the Committee learned with very great regret from Mr. P. J. Burgess that he felt compelled to resign the Chairmanship of the Committee, a position which he had occupied with considerable ability and success for over 20 years. They are glad to report, however, that his long and practical experience of plantation rubber research will not be lost as he has agreed to continue serving as an ordinary member of the Committee. Mr. E. W. Whitelaw was elected unanimously as his successor; Mr. Whitelaw resigned as a representative of Ceylon planting interests, on appointment by the Government of Ceylon as their representative *vice* Mr. L. Lord of the Colonial Office.

The Committee have also to record with regret the resignation of three members, who have given long and valuable service, *viz.*, Lieut.-Colonel J. Sealy Clarke, Sir Eric Macfadyen and Mr. G. H. Masefield. Dr. S. S. Pickles has succeeded Lieut.-Colonel Sealy Clarke as the representative of the Research Association of British Rubber Manufacturers and the Rubber Growers' Association has nominated Messrs. A. M. Clarke and E. R. Corbett to fill the two vacancies for representatives of the Ceylon planting interests. The appointment of a successor to Sir Eric Macfadyen was under consideration by the Association at the end of the year. The Committee and the Technical Sub-Committee have both continued to hold three meetings a year and meetings of special Sub-Committees have been held as and when required to consider applications for filling vacancies on the scientific staffs of the Ceylon Rubber Research Scheme and the Rubber Research Institute of Malaya, and for dealing with estimates and other matters of internal administration.

The arrangement which has been in force for many years, under which all members of the Committee served on a Technical Sub-Committee meeting earlier on the same day, was discontinued during 1949, at the suggestion of representatives of planting interests who find it increasingly difficult to follow the detailed reports of the scientific investigations in London. As a result the Technical Sub-Committee now consists of the former co-opted members (rubber technologists) under the Chairmanship of Mr. Martin. The Agenda papers and reports with invitations to attend meetings are circulated to any member of the main Committee wishing to receive them. The Technical Sub-Committee now meets about a fortnight in advance of the main Committee and submits to the latter a summary of the practical conclusions arising out of the investigations they have considered. This arrangement enables the main Committee to devote more time to important agricultural problems connected with production research in the East.

Detailed reports of the work of the Technical Sub-Committee are regularly supplied to the scientific staff in the East as a result of which they are kept regularly informed of manufacturers' reactions to proposals for technological progress affecting both manufacturing and planting interests.

During the period under review the Selection Sub-Committee dealt with a large number of applications received in answer to advertisements issued for posts on the European staff in Ceylon and Malaya. They were able to select officers for the post of Director, Oidium Research Officer, Chemist and Agronomist in Ceylon, a Botanist, Biochemist, Statistician, Rubber Technologist, Chemical Engineer and Advisory Officer in Malaya. No suitable candidates could be found to fill vacancies for the posts of Agricultural Engineer, Microbiologist, Physical Chemist and Analyst in Malaya.

Arrangements were made for Dr. Risdon to receive three months' preliminary training in the Committee's laboratories before proceeding to take up the post of Chemist in Ceylon in April 1951. Advice was given to the Scheme on the selection of plant and equipment required for their new rubber testing laboratory.

Finance.—The Committee are pleased to record that in order to meet the rise in expenditure of staff, plant and equipment, the Boards of the R.R.I. and the R.R.S. have agreed to increase their contributions to the work in London during 1951 to £ 11,200 and £ 2,300 respectively.

Staff in London.—As stated in the Report for 1948, Mr. H. C. Baker was seconded to the Chemical Division of the Rubber Research Institute of Malaya for a period of two years. He left Malaya in March, 1950, and returned to duty in London. As his departure from the R.R.I. would create a serious gap in the Chemical Division staff, the Committee agreed to the secondment of another of their senior officers (Mr. W. G. Wren) to replace him for a period of one year. This secondment was subsequently extended until the end of 1951, in order that Mr. Wren might act for Mr. M. W. Philpott, the Head of the Division, whilst he was on leave.

Co-operation with other Organisations.—In September, 1949, Mr. Martin, Superintendent of Investigations, paid a short visit to Holland to attend meetings of the International Standards Organisation dealing with the standardisation of tests for latex and vulcanised rubber. At these meetings agreement was obtained on an international basis on methods for determining dry rubber content, total solids and alkalinity of latex and on the sampling of latex in drums. The recommendations made at these meetings are incorporated in British Standards Institution specifications and adopted by the Rubber Trades Association.

Mr. Martin then proceeded to Malaya for a Conference of rubber research and trade organisations in the East, called by the Director of the Rubber Research Institute to discuss possible improvements in the quality of raw rubber. At this Conference it was agreed that the research organisations should give priority to the study of the French proposals for offering raw rubber distinctly marked so as to indicate its approximate technological characteristics. This visit provided a useful opportunity for personal consultation with the Directors of the Rubber Research Institute and of the British Rubber Producers' Research Association, enabling decisions (which could otherwise not have been obtained) to be reached on a number of important problems of mutual interest, particularly in regard to the relative functions of the three organisations and the divisions of work between them.

In October, 1950, Mr. Martin spent one month in the U.S.A., where he took part in the annual meeting of the International Standards Organisation. At this meeting the work on latex dealt with at the Conference in Holland in 1949 was continued, special attention being paid to the standardisation of a test for mechanical stability; attention was also given to the standardisation of details of tests on raw rubber, which would be suitable for use in connection with a scheme of classification by technological properties and considerable progress was made. Mr. Martin was also a member of the British Delegation from the Institution of the Rubber Industry to the International Conference of the Rubber Division of the American Chemical Society, held at Cleveland, and he took part in the discussions on several of the papers. He also visited a number of rubber factories and research centres and made a study of the conditions of rubber on arrival at the docks in New York.

Close co-operation has been maintained with other organisations connected with rubber research matters in this country and Messrs. Martin and Baker continued to serve as members of the Committees listed below:

British Standards Institution:

Latex—G. Martin (Chairman).
International Standards Organisation—G. Martin.
Cellular Rubber—G. Martin.
Raw Rubber—H. C. Baker.
Rubber Industry—G. Martin.

Research Association of British Rubber Manufacturers:

Intelligence Committee—G. Martin.
Research Committee—
Latex Panel—

Institution of the Rubber Industry:

Papers Committee—G. Martin.
Education Committee
Finance Committee
Examinations Board
Council— (Vice-President).

British Rubber Development Board:

Road Surfacing Committee—G. Martin.

Dr. S. P. Wiltshire proceeded to Malaya in 1949 in order to attend the South-East Asia Phyto-Sanitary Conference in Singapore, at which means of combating the threat of South American Leaf Disease (*Dothidella ulei*) were discussed. He took the opportunity of visiting the Rubber Research Institute of Malaya and on his return journey to England spent a short time at the Ceylon Rubber Research Scheme. He also saw some of the areas affected by oidium in Ceylon and discussed measures of control with the staff of the Scheme. Following discussions with him on this visit the Committee decided to ask the Colonial Office to raise with the Ministry of Agriculture the importance of providing additional glasshouse accommodation at the Royal Botanic Gardens, Kew, in order that adequate quarantine facilities may be available for plant material in transit in connection with the proposed intensive search for strains of *Hevea* resistant to disease. Subsequently the Committee also had the advantage of discussing with the Director of the Rubber Research Institute and the Head of the Pathological Division, when these officers were on leave in London in 1950, the results of the negotiations they had carried out in Trinidad, U.S.A., and South America for co-operation between the Eastern and Western tropics in this and other investigations of importance to the rubber planting industry.

Investigations.—The work carried out during the period under review has been chiefly concerned with the following subjects:—

(1) The French proposal that rubber should be marketed classified by certain technological tests. The investigations have been directed particularly to a study of:—

- (a) the reproducibility of results at different testing stations ;
- (b) changes in the technical properties of raw rubber on keeping ;
- (c) the relative behaviour of different rubber in different test formulae ;
- (d) the simplification of testing procedure ;
- (e) the possibility of a modification of the French scheme by the inclusion of a test for "liability to scorch," which is regarded as of great importance to manufacturers.

The general indications of these investigations are that effective technological classification is somewhat more complicated than was anticipated, the chief difficulty being the imperfect correlation between the behaviour of rubber in a simple test compound and in the more complex mixtures normally used for manufacturing purposes. The evidence indicates that the French system should be of practical value to manufacturers and over a long period help natural rubber to compete with synthetic.

(2) The practicability of preparing in the East from latex, lignin and carbon black rubber masterbatches.

Lignin is at present somewhat of a waste product from the paper pulp industry; it is easily dispersed in latex but not in dry rubber. The experiments suggest that lignin might be useful as a diluent for rubber without obviously harmful effect on the vulcanised product and that it can be used to prepare carbon black masterbatches from latex which on vulcanisation are more resilient than those from dry rubber. Unfortunately the process is a little more expensive than dry mixing and is covered by American patents.

(3) Latex: In this field a considerable part of the work has been directed to the standardisation, in association with the British Standards Institution, of the procedure for carrying out the tests for latex adopted by the rubber trade.

Considerable strides have been made in Malaya in developing new preservatives and samples have been sent to London. All except one have remained fluid and may be more or less suitable for some manufacturing purposes than the usual type of ammonia-preserved latex. This can only be established at present by large-scale manufacturing trials. In the meantime attempts are being made to develop practical laboratory tests which can be used to sort out preservatives worthy of further study. Preliminary results indicate wide differences in the behaviour of latices containing different preservatives.

Studies have been made in association with the Printing, Packaging and Allied Trades Research Association of new wrapping materials for rubber in bales. Some of them appear to be useful in ensuring the cleanliness of rubber in transit, but would inevitably add a little to the cost of packing.

A detailed account of the above investigations is given in the Report by the Superintendent of Investigations, which follows.

SUPERINTENDENT'S REPORT

Owing to exceptional circumstances at the beginning of 1950, the preparation of the 1949 report was delayed for twelve months. The present report therefore covers the two-year period 1949 and 1950.

During the first nine months of 1949 the research carried out was a continuation of that of previous years and was determined by the Committee's view that the present method of grading rubber on appearance was accepted by manufacturers. Towards the end of the war, the latter had been asked to give their views on what improvements were desirable in plantation rubber and had not put forward requests for a radical change. They considered that smoked sheet as marketed pre-war was on the whole satisfactory, but that improvements were desirable in cleanliness and in uniformity of technical properties.

Accordingly, the aim of research in the early part of 1949 was to continue to obtain information about factors affecting variability with a view to advising producers on details of preparation so as to obtain a more uniform product, and to associate this work with an attempt to develop rubber with improved technical qualities for tyres and special types of rubber for other purposes.

A visit which the writer paid to Malaya in September, 1949, at the request of the Director of the Rubber Research Institute, led, however, to some rearrangement of the work and of its immediate objectives. The main purpose of this visit was to attend a meeting of rubber technologists from Europe and the Far East and trade representatives from Malaya to discuss the possibility of improving the preparation and marketing of rubber. It was unanimously agreed that as long as natural rubber is graded solely on appearance, it will be at a disadvantage in this respect compared with synthetic rubber, each type of which is marketed to conform with a specification based on technological tests. Because of the importance of ensuring the continued technical supremacy of natural rubber and the restricted possibility of improvement as long as appearance remains the sole criterion of suitability for manufacturing purposes, it was decided to study the French proposal to classify rubber by two technological tests, one based on plasticity and the other on vulcanising properties, and, with the co-operation of commercial interests in Malaya, to explore without delay the possibility of supplementing the present system of grading on appearance with technical classification in accordance with the French proposals, first made known to the Rubber Study Group in 1949 and subsequently approved by them in 1950.

Although the main facts about variability are known, having been studied over a period of many years, the Malayan decision necessitated that many details should be established on a strictly quantitative basis appropriate to post-war conditions. It was obvious that the main burden of this work would fall on the research organisations in the East. It was agreed therefore to supplement the staff in Malaya with experienced technological staff employed by the Committee. A similar decision to help with suitable staff was also made by the British Rubber Producers' Research Association. The Committee's staff is only a small one compared with that of other Rubber Producers' Research Organisations and for a time in 1949 and again in early 1950 two of the three members of the Senior staff were in Malaya. A rearrangement of the work in London was therefore necessary. In addition, it was obvious that some aspects of technical classification must be studied in consuming countries, a type of work with which the staff in London is familiar, and that this work must be given priority if the recommendations of the Malayan meeting were to be implemented as quickly as possible.

This was the first occasion on which the heads of all the British Research Organisations supported by rubber-producing interests, had assembled together, and the Director of the Rubber Research Institute took the opportunity to discuss the co-ordination of relevant portions of the work of each organisation. Programmes were arranged to avoid duplication of effort and to ensure an intensive attack on the problem of classifying rubber by technical tests.

Technically Classified Rubber

In accordance with these arrangements the contribution of the Committee's staff to the problem of marketing technically classified rubber has been in the following directions: (1) factors affecting the reproducibility of test results, (2) changes in test results on keeping rubber for various periods under different conditions, (3) behaviour of classified rubber when compounded with different ingredients used in manufacturing practice, (4) simplification of test procedure.

Because of their importance in assessing the practical value to manufacturers of technically classified rubber, work on the above subjects is described at the end of this Section in some detail. The general trend of the results indicates that although different laboratories using these tests may obtain results at different levels, they should have much less difficulty in arranging samples in substantially the same order. Some changes occur in the properties of rubber on keeping but, there is no evidence, so far, that they have a substantial effect on differences between samples. This

conclusion is restricted for the present by the limited information available about the effect of long periods and different conditions of storage. Probably the most important factors affecting the practical value of the French classification are (1) the substantial levelling-up of vulcanising properties which occurs in the highly-loaded compounds used for the bulk of manufactured articles, and (2) the rearrangement of the order of the samples when chemically different classes of accelerators are used.

None of this information is new or surprising but it needed confirmation ; rubbers could not be expected to maintain their relative differences in all the miscellaneous compounds used by manufacturers. The proposed classification will, however, prove of practical value if it enables users to avoid most of the abnormal rubbers which cause appreciable difficulties in the manufacture of articles which consume the bulk of the world's supplies of rubber. By this criterion the French system serves a useful purpose.

At meetings of the Technical Sub-Committee, representatives of manufacturers have pointed out that the chief value of a grading scheme based on technological tests is to identify distinctly abnormal rubbers. These rubbers are not inferior but may require special blending for ordinary uses and may be of superior value for special uses. Similar views about the importance of using a scheme of technological classification to identify distinctly abnormal rubber were expressed at a meeting of representatives of British manufacturers organised by the Trade Associations at the request of the Committee to discuss the value to manufacturers of technically classified rubber. This meeting was particularly useful to rubber producers because not only was unanimous approval given to the French proposals in general terms, but it was also agreed that the suggested scheme of tests was satisfactory for a start, with the proviso that class limits should be arranged so that 70 per cent. of rubber is graded as normal with 15 per cent. of abnormal rubber on each side of the middle class. The meeting also emphasised that an important aspect of classification is its relation to the liability of rubber to cause processing difficulties due to "scorching" (prevulcanisation) in manufacturers' compounds. This aspect of classification has so far only been studied in a small way.

The more detailed account of the above work which follows is reviewed under the headings (1) reproducibility of results, (2) changes in rubber on keeping. (3) relative behaviour of rubbers in different compounds, and (4) simplification of test procedure.

(1) *Reproducibility of results.*—One of the difficulties of classifying rubber by technical tests is in obtaining the same level of results in different laboratories, although nearly all laboratories tend to arrange samples in the same order. Even in the same laboratory there are times when the level of the results appears to change without the cause being obvious. To obtain reliable information about the reproducibility of results in one laboratory requires many replications of experiments over a long period. It will therefore be some time before comprehensive information can be given about the reproducibility of results of tests in the Committee's laboratories.

The procedure for measuring vulcanising properties in terms of modulus or strain, as required in the French scheme of classifying rubber according to technological properties, consists of three principal operations, viz., mixing, vulcanising and testing. The one which was found to be the chief source of variability in results is the operation of mixing. Owing to a breakdown of the laboratory rolls normally used for this purpose, mixing had to be done for a time on miniature rolls, which it was found appreciably increased the liability to error of the test results, except when the ingredients were added as a masterbatch. On the laboratory rolls normally employed for the purpose, the mixing operation still remained the chief source of differences in test results. Reproducibility was considerably improved, however, by

mixing the compounded stock to a fixed plasticity, an operation which is facilitated by adding all the ingredients except sulphur in the form of a masterbatch. This also saves mixing time.

To obtain agreement between different laboratories it is important to ensure that variation does not occur between different lots of the same compounding ingredients. In this connection it was found that the purchase of accelerator from three different sources gave no indication of an appreciable effect on the variation of test results. Of the other ingredients zinc oxide is perhaps the most likely to cause difficulty but has not yet been studied in London.

Variations in the humidity of compounded stock within the limits likely to occur in different countries had a small effect on test results, but is easily controlled by keeping the compound under standard humidity conditions. Different methods of moulding and different positions of individual moulds in the vulcanising press had no detectable effect on the results. In testing Schopper rings it was found to be appreciably more accurate to measure modulus by direct reading during test than by measuring the stress strain curve.

The above conclusions all refer to the unloaded standard test compound, *i.e.*, A.C.S.I formula, which is the one used in the French Scheme for classifying rubber. Similar studies have also been made of sources of error in tests using a carbon black compound of the tyre tread type. The mixing errors are much greater than in the A.C.S. compound, and more difficult to control. As the differences in test results between rubbers are much less in this compound than in the A.C.S. formula, the ability of the black compound to discriminate between rubbers is not so good. One method of mixing involving premastication seemed to give much more reliable results than others, but this conclusion is based on too few replications to be firmly established.

It is sometimes suggested that results of more practical value would be obtained by classifying rubber on the basis of results in a carbon black compound, which is far more typical of those used by manufacturers than is the A.C.S. compound. The practical difficulties are, however, formidable and the present test compound has the advantage of sensitivity and speed of testing.

It has been customary to measure the plasticity of rubber by means of the parallel plate plastimeter. It was evident, however, in 1949 that the Mooney instrument was the only one likely to secure international approval, and so a Mooney instrument was acquired during 1950. There were a few teething troubles of which the most serious was the difficulty of maintaining temperature within the required limits. A new heating circuit with suitable controls was designed and installed and is now giving satisfactory results. So far it appears that the experimental error of plasticity determinations is at most not greater than those reported by other laboratories. Based on the experience gained, an improved instrument is now being constructed.

Although the measurement of resilience does not enter into the proposed tests for technically classified rubber, it is of considerable importance because the resilience is one of the important properties which largely determine the superiority of natural over synthetic rubber in tyres and because an aim of research in London is to indicate how to obtain a still more resilient natural rubber.

For routine measurements it is convenient to use a modified Dunlop Tripso-meter. The one purchased was adapted by the makers at our request to facilitate the measurement of the correction factor for damping errors. After a short period of use the heating units were redesigned to obtain a better control of temperature, a vernier scale was attached to the instrument to facilitate accurate reading, a stop was fixed to the scale to ensure that the pendulum always fell from the same height,

the swing of the pendulum was started by the release of a solenoid brake to avoid imparting momentum to the swing, mechanical friction was reduced by remilling critical moving parts and special ball bearings introduced. The best conditions of lubrication for reliable results were studied. The most important improvement, however, was the elimination of error due to "block shuffle" by applying a partial vacuum to the back of the specimen. With all these modifications it was found possible to reduce the coefficient of variation of a single determination in a pure gum compound to within 1 per cent., including errors due to mixing and vulcanisation. The error in carbon black compounds is higher, not only because of the larger mixing error but also because pre-conditioning of the test specimen affects the results. This latter aspect of resilience measurements has not yet been fully explored. At the end of the year a paper on the mechanical modifications in the instrument and on testing error was in the course of preparation.

The Committee's staff is contributing with others to the work of the British Standards Institution and International Standards Organisation in standardising test methods on a national and in some cases on an international basis. This work requires a considerable amount of attention to detail. It tends to occupy an appreciable amount of the time of the senior staff and has required experimental work by the junior staff. Despite the difficulties which sometimes still occur in obtaining the same level of results in different laboratories, there is no doubt that the position would have been much worse but for the work of the national and international standardising organisations. Particularly good progress was made at the International Standards Organisation meeting in 1950 in standardising for the first time at an international level the method of testing to be employed in determining the plasticity and vulcanising properties of rubber.

(2) *Changes in rubber on keeping.*—It is obviously of importance to know what changes are likely to occur before use in rubber which has been classified by technical test in Malaya. The work on this subject was not completed at the end of the year. So far, it is known that the modulus results obtained in London tend to be higher than those in Malaya but this may be influenced by a difference in the level of test results in the two laboratories.

The effect on vulcanising properties and plasticity of keeping raw rubber for some time was studied twenty years ago in the Committee's laboratories when rubber was tested in a rubber-sulphur compound and not the A.C.S. accelerator compound now used. The details of these storage results have never been published. They were obtained in the course of co-operative tests with de Vries of Java who was then making a large-scale effort to market 'Certificate rubber.' This rubber was tested at the Buitenzorg testing station by vulcanisation in a rubber-sulphur compound and sold with a certificate of uniformity if the rate of vulcanisation came within fixed limits.

For the storage tests three random samples of certificate rubber were selected in Java each month for a period of twelve months. They were tested in Java within twenty-four days of preparation and again after intervals of six and twelve months. They were tested in the Committee's laboratories on arrival and after storing for both six and twelve months at 15°C. The correlation between the results of vulcanisation tests in Java and London was 0.53 which was "as good as can be expected considering the smallness of the variation" between these samples (*R.R.S. Ceylon Bull.* 22, p. 27). In the London tests the time of vulcanisation during twelve months storage increased in every case, but the average increase was only 4 per cent. In Java the increase in time of vulcanisation was less regular than in London and the average amounted to only 2.5 per cent. It is of interest that the samples showing the biggest change were the same in Java and London and were prepared during the wet season.

On the whole these results indicate that the changes in test results on keeping rubber would not be sufficient seriously to upset a system of classification, based on tests in a rubber-sulphur formula, which may be regarded as a pointer to the changes which are likely to be found in tests in the A.C.S. compound. The changes are very small and only likely to affect the classification of borderline samples, but there would be exceptional occasions when classification in the East would disagree more seriously with a European classification say six months later.

In plasticity tests, which were made with a parallel plate plastimeter, there was excellent agreement in the level of results in Java and London, but the samples stored in Java became appreciably less plastic during a period of twelve months. The samples stored in London also generally became harder but the differences were not so marked. In subsequent tests in London it was found that changes in plasticity on keeping depended on temperature and humidity of the atmosphere. The higher the temperature up to about 40°C and the drier the atmosphere the more marked the effect on plasticity. It is difficult to estimate from the data available the effect of these changes on plasticity measured in terms of Mooney viscosity instead of a parallel plate plastimeter. On the whole it would appear that changes between a first test in the East and a subsequent test in the country of use are likely to have a larger effect on the level of results than on differences between samples.

(3) *Relative behaviour of rubbers in different compounds.*—As the test compound contains only a small proportion of stearic acid, it was suspected that differences in the results given by different rubbers might be chiefly due to variation in the natural fatty acids present and that this variation would not agree with that experienced by manufacturers who usually add more stearic acid to their compounds. It was found, however that, differences between rubbers were substantially maintained when the amount of stearic acid in the test formula was appreciably increased.

As long ago as 1923 the Committee's staff showed that there could be marked discrepancies between the relative vulcanising properties of different rubbers in two compounds, one containing sulphur only and the other an added accelerator (*J.S. C.I.*, 1923, 42, 98T). Again in 1926, Dinsmore and Zimmerman (*Ind. Eng. Chem.*, 1926, 18, 144) showed that different accelerators arranged samples in markedly different orders. It is not surprising therefore that an examination in 1950 of the comparative behaviour of range of samples in different compounds confirmed these well known conclusions.

In one experiment a series of 16 clonal rubbers ranging in modulus according to the French system of classification from the low-medium border to the high-medium border gave similar relative results in a compound containing accelerators chemically related to those in the standard test recipe, but the correlation was hardly significant in a compound containing a chemically dissimilar accelerator and was also poor in one containing sulphur only without added accelerator. The fact that the relative vulcanising behaviour of different rubbers varies with the type of accelerator is undoubtedly a difficulty in any system of classifying rubber by vulcanising properties, but is less serious than it might be because of the marked popularity in manufacturers' recipes of the class of accelerator used in the standard test formula.

Of more importance is the effect of carbon black which is a constituent of the bulk of manufacturers' compounds of which it is the chief ingredient because of its beneficial effect. The 16 clonal rubbers referred to above which showed moderate differences in the standard test formula displayed hardly significant differences in a tyre tread compound, and in the few cases where the differences appeared to be just significant they were in one instance in the opposite directions to that indicated by the standard test formula.

In their discussions on technically classified rubber, British manufacturers have emphasized that one of its most important advantages would be the elimination of scorching by selecting the class or mixture of classes of rubber suitable for the manufacturing processes involved. Unfortunately, the results of scorching tests in the tyre tread compound did not agree very well with vulcanising behaviour, as determined by modulus in any compound.

An examination of three rubbers, which had been classified in Malaya by their vulcanising behaviour in the standard test compound, one of them being in the low modulus class, a second in the medium and the third in the high, gave no indication of significant differences either in vulcanising behaviour or in some of the physical properties of the vulcanised product, including modulus, hardness and abrasion, when tested in two tyre tread compounds containing two different grades of carbon black (MPC and RF). The medium modulus rubber was superior to the other two in tear resistance and the high modulus rubber in resilience, the low modulus rubber being inferior in both properties. The high modulus rubber scorched more easily than the low modulus rubber and the difference was more marked in the MPC tread compound than in the RF compound. On the whole these results support the conclusion that although moderate differences between the moduli of rubbers in the test formula almost disappear in a tyre tread compound, other differences are produced which there are good reasons to believe are of considerable practical importance.

The results of a similar but more comprehensive study made in 1945-46 are of particular interest because the rubbers examined included some selected by the Goodyear Rubber Co. (Wolverhampton) to represent a range of samples typical of the vulcanising variation experienced in manufacturing practice. The series also included some clonal rubbers and some specially prepared samples supplied by the Rubber Research Institute of Malaya. The greatest differences between the samples were found in the standard test compound. A tyre tread skeleton compound (no carbon black) reduced the differences a little, but the addition of carbon black led to a marked levelling of the results. There was, however, a broad correlation between modulus results in the loaded and unloaded compounds. The samples supplied by the Goodyear Rubber Co. displayed the variation reported by them when tested in the standard and in the tyre tread skeleton compound. In the tyre tread compound the Goodyear low modulus rubbers, the medium and one of the high modulus rubbers gave no indication of any differences in modulus between them, and only the highest of the high modulus rubbers gave a value higher than would normally be accounted for by experimental error. Tear, resilience and hardness in the tyre tread compound could not be definitely related to modulus in the pure gum compound.

These results have been described in some detail because of their relation to the practical value of the French system of classifying rubber according to vulcanising properties. The bulk of manufactured rubber is loaded with carbon black and other materials and if the levelling up which occurs is combined with the limited correlation between the relative behaviour of chemically dissimilar accelerators and changes which occur in rubber on keeping, doubts might be felt about the practical value of the French system of classification for the bulk of rubber used by manufacturers. In the opinion of the writer such conclusions are unsound, partly because they are based on modulus measurements and ignore differences in such important properties as resilience and rate of scorch which still occur and are sometimes increased in loaded compounds. Moreover a technological grading scheme which is admittedly not perfect is far better than none at all. An important lesson which can be learned, however, is the undesirability of stressing small differences in the behaviour of different rubbers in the standard test compound. Its chief value is in the detection of distinctly abnormal rubbers, and there is no evidence in this report to indicate that in this respect it will not serve an extremely useful purpose.

(4) *Simplification of test procedure.*—It is obvious that the difficulties associated with vulcanisation tests for classification purposes would be eliminated if the chemical factors responsible for variation could be determined and used as a basis of classification, leaving manufacturers to determine for themselves the precise effect of these active constituents on their compounds. There is a general impression that nitrogenous bases are chiefly responsible and some years ago the Committee's staff showed that "matured" rubber which vulcanised quickly contained an increased amount of nitrogenous constituents soluble in acetone. A determination of these constituents was, therefore, made in the 16 clonal rubbers referred to previously in this report in connection with their relative vulcanising behaviour in a range of compounds. No correlation with vulcanising behaviour in any compound could be detected.

The original French proposals were to measure modulus (*i.e.*, load required to stretch the test piece 600 per cent.) after a fixed period of vulcanisation as a measure of vulcanising properties. This test involves the use of an expensive machine, which new laboratories would have difficulty in obtaining in less than two years. The National Bureau of Standards in the U.S.A. have devised an ingenious machine for automatically measuring strain (*i.e.*, elongation under a fixed small load). A simplified and relatively cheap strain-tester was subsequently designed by the British Rubber producers' Research Association. One of these machines was acquired and comparative tests carried out with the British Rubber Producers' Research Association. On the whole excellent agreement was obtained in tests on duplicate test pieces in the two laboratories. In the tests so far carried out there is not much difference in the reproducibility of strain or modulus results, although in other laboratories the claim has been made that strain measurements are the more reproducible relative to the extent of differences between rubbers. At present modulus and strain tests are regarded as alternative and equally valid methods of measuring state of vulcanisation.

Scorching.—The views of associations of British rubber manufacturers, as expressed in the official report on their meeting to discuss technically classified rubber, appear to imply that the control of "liability to scorch" is of the utmost importance. A study of this subject was therefore commenced in 1950.

Two methods of test were tried, one using the parallel plate plastimeter to determine the period of heating at 110°C required to cause an increase in hardness and elasticity of compounded stock. The other was the usual Mooney test at 250°F (121°C). In neither case was the reproducibility of test results altogether satisfactory, but this would not account for the large discrepancies in the order of "liability to scorch" of a range of samples tested by both methods. The effect of different conditions of test on the reproducibility and level of results is now being studied in greater detail.

Evidence has been obtained that serum constituents from preserved latex contain powerful scorching promoters, of which an effective part is removed by dialysis. These scorch promoters are largely soluble in acetone and in soluble in ether.

It has also been shown that alkyl diamines strongly promote scorching; amino acids do not have such a marked effect. Some potassium salts are also scorching agents. An interesting observation is that the acetone extract of smoked sheet contains anti-scorching agents.

These investigations are only of a preliminary character. Much more work is required before conclusions of practical value can be obtained.

Lignin and Carbon Black Masterbatches

Published reports indicate that the addition of carbon black to synthetic rubber latices leads to an improved product as compared with those prepared in the usual way from dry rubber. It has also been reported that lignin, at present somewhat of a waste product from the paper pulp industry, is an excellent dispersing agent for carbon black in latex and that lignin itself when added to latex reinforces rubber. There is, therefore, a reasonable possibility that rubber-carbon black and rubber-lignin masterbatches prepared in the East from fresh latex, would have technical advantages. These advantages would have to be considerable, however, to compensate for the inevitably higher cost of adding either carbon black or lignin to fresh latex as compared with the cost of the addition to dry rubber. The patent situation may also cause difficulties.

To explore the position, masterbatches were prepared from preserved latex. The chief difficulty was to obtain a coagulum of rubber and carbon black and (or) lignin from which appreciable quantities of the added ingredients were not lost to the serum and wash water. The success of the method eventually adopted depended on thorough dispersion of lignin and carbon black in aqueous alkaline media, vigorous mixing with latex, particularly during the early stages of coagulation, "shock" coagulation in the presence of a suitable thickening agent followed by complete coagulation on a waterbath.

It was found that large quantities of lignin could be added to latex without difficulty and converted into rubber-lignin masterbatches which after vulcanisation are strong, resistant to tear and highly resilient, but too soft to resist abrasion like rubber containing the same volume of "reinforcing" black (the grade normally used in tyre treads).

Lignin was found to be an excellent dispersing agent for "reinforcing" black, and the vulcanised compounds were more resilient than those obtained by dry mixing. In the presence of a small amount of lignin, sufficient to disperse the black, there was also an improvement in tensile and tear strength, but as the proportion of lignin was increased and that of the black decreased, to keep the volume loading the same, there was a corresponding decrease in hardness and resistance to abrasion. The chief advantage of carbon black masterbatches appeared to be in improved resilience.

A general impression was formed that the effect of lignin is similar to that of a semi-reinforcing black as used in tyre side walls, but that the lignin compounds are superior in resilience. It was also concluded that lignin may be useful as diluent for rubber, particularly valuable in time of rubber scarcity. Lignin masterbatches may also be suitable, particularly if treated with hardening resins, for the manufacture of non-staining shoe soles and for other mechanical purposes.

To ascertain if these advantages are sufficient to cover the cost of preparation, it is hoped to obtain from the East a few trial lots of both lignin and carbon black rubber masterbatches for distribution to manufacturers.

Packing

A fully satisfactory packing material for rubber has yet to be found. Wooden cases, hessian wrapping and bareback bales have all been used on a large scale and have all been criticised by manufacturers. Wooden cases are no longer available for the bulk of rubber, but were a source of complaint due to contamination of the rubber with splinters. Hessian-wrapped rubber often becomes contaminated with fibres and the bales are liable to become badly distorted in transit. Bareback bales are even worse in this respect; markings become illegible and some of the dusting powders, used to prevent massing, cake into hard particles which have to be removed by brushing and straining.

A recent inspection by the writer of rubber arriving at the New York docks showed, as expected, that deformation and illegibility were most marked in low grade, soft, remilled rubber. Some good quality sheet was also badly misshapen, but that from one estate, which it was known thoroughly compressed its rubber before wrapping in bessian, arrived in good shape, outstandingly different from the rest of the shipment. An appreciable portion of the various consignments had been dusted with powder which had caked into hard, gritty particles. This shipment was presumably typical of those arriving in U.S.A. and fully confirmed the seriousness of manufacturers' complaints.

It is evident that a new method of packing rubber is badly needed. The last 10 years has seen the introduction of a number of new synthetic wrapping materials, and enquiries were made in 1949 of the Printing, Packaging and Allied Trades Research Association in case any of them were likely to be useful for rubber. It was at first decided that all could be ruled out on account of expense, but this view was subsequently modified because of possible price-reductions due to larger output and improved manufacturing processes and because of new materials appearing on the market during 1949.

The Printing, Packaging and Allied Trades Research Association recommended that experiments should first be made with collapsible, waxed fibre-board cases, two halves of which fitted into each other so as to provide a double wall thickness at the sides, the flaps providing a similar double thickness at the ends. These were specially made at an estimated cost of about 3'6 per carton for large quantities and were supplied to the Rubber Research Institute with some alkathene wrapping sheet, an inert, transparent reasonably strong non-adhesive synthetic resin, the presence of which in small quantities would be harmless to rubber compounds.

Each carton measuring $18\frac{3}{4} \times 18\frac{3}{4} \times 14$ ins. held about 150 lb. of rubber and arrived in excellent shape with only minor damage to corners. The contents had been wrapped in the alkathene sheet some of which was torn a little, but still substantially protected the rubber from contamination. Labels beneath the transparent alkathene wrapper were clear and easily read. The most surprising feature of the trial was that the rubber no longer filled the cartons, as if some consolidation had occurred in transit. This probably accounted for the fact that on arrival nearly half the steel bands, which held the cartons together, were missing.

The results of this trial were regarded as very satisfactory and it is considered that the experiment is worth repeating on a larger scale with cartons each holding at least two cwt. of rubber. It is, of course, a more expensive form of packing than bareback bales. The cost of materials will undoubtedly exceed 5/- per bale.

A further shipment of rubber in 75 lb. bales wrapped in various resin-treated paper and cloths, with and without inside resinous wrapping material, was not so successful owing to tearing in some cases of the outside wrappers. Nevertheless accidental circumstances play such a large part in these small shipments that the experiment ought to be repeated before drawing firm conclusions.

It seems clear that improved methods of packing rubber are available, but obviously they cannot be as economical to the producer as bareback bales. The extra cost may, however, be justified by the advantages to shippers and manufacturers.

Peptisation and Gelation

Why commercial grades of rubber display appreciable variation in plasticity is not known, but it would be a useful advance if practical means were available for controlling plasticity. There is a potential demand for rubber distinctly softer than the average and also for that which is harder than usual. Methods of preparing harder and softer rubber are known but the information available is limited and somewhat unrelated owing to the difficulty of studying fundamental issues.

Most of the measurements in the Committee's laboratories have been of the total extent of deformation when a fixed amount of rubber of a prescribed shape is compressed between two parallel plates under a fixed total load at a fixed temperature for a prescribed time. An alteration in the conditions of test is liable to alter the relation between comparative results, and attempts have been made therefore to obtain values more nearly related to basic properties. In general it was found that the harder the rubber, the more complex was the relation between stress and rate of shear, and the greater the proportion of the flow due to elastic deformation. Hard rubber was also more resilient than soft rubber and swelled less in solvents. There were, however, many striking anomalies. In some respects the different properties appeared to vary independently of each other and it was evident that the subject requires much more elaborate study than it has so far been possible to make.

By the use of suitable solvents rubber can be divided into fractions which differ in plasticity. It is found that the relatively soft, soluble sol fraction is hardened much more than the hard gel fraction by the usual hardening agents, so that after treatment both sol and gel rubber have approximately the same plasticity. Similarly, peptising agents are found to soften gel more than sol rubber until they both reach approximately the same plasticity. These results suggest that rubber treated with gelling or peptising agents will be fairly uniform in plasticity, the degree of plasticity depending on the nature of the treatment. The results also explain why hardening agents are irregular in their effects. A rubber which is already hard owing to natural impurities is not likely to increase in hardness as much as a soft rubber when treated with hardening agent.

When highly purified rubber is prepared from preserved latex in the presence of air, the rubber is usually somewhat soft although normal rubber from preserved latex is rather hard. When the purified rubber is prepared from latex containing a suitable antioxidant, the rubber is relatively hard. Antioxidants are not necessarily hardening agents, but the latter are usually antioxidants and the chemical constitution of antioxidants and hardening agents are closely related. It is possible, therefore, that the hardness of the purified rubber prepared in the presence of antioxidants is due to hardening effect of the antioxidant even though it has no such effect on commercial rubber. It was found, however, that purification in an atmosphere of nitrogen in the absence of oxygen also yielded a hard rubber, indicating that the softness of purified rubber prepared in air is due to oxidation.

Hardening agents are materials which might owe their effect to a tanning of the protein naturally present in normal rubber, but since it is found that they harden purified rubber as much as they harden normal rubber and rubber containing added protein, it is concluded that the increased hardness is due to a change in the rubber hydro-carbon and not to a modification of the natural impurities.

An interesting difference between hardening and softening phenomena is that softening agents are very slow in their effect at normal temperatures. For several days after treatment of rubber with a softening agent, softening can be prevented by extracting the added reagent, but if the rubber is heated for a minute or two at say 100°C, softening occurs immediately and extraction of the rubber with a solvent for the softening agent does not lead to recovery of hardness. Hardening agents, on the other hand, appear to be effective quickly at ordinary temperatures and treatment of the rubber with a solvent for the hardening agent shortly after it has been added does not lead to a softer product.

Attempts to correlate hardening with the chemical constitution of the hardening agent confirm that the most effective are certain disubstituted aromatic compounds containing the substituent groups OH, NH₂ and NO. In accordance with these results unsaturated polyhydroxy compounds are usually hardening agents, but the corresponding saturated compounds are not. This explains why Quebrachitol, a

normal constituent of Hevea rubber, is not a hardening agent. The hardening agents tried, all darken on exposure to air and are, therefore, not suitable for the treatment of sole crepe. It is of interest that tartaric acid was found to be an excellent antioxidant for raw rubber. It did not harden the rubber but, as expected, markedly retarded vulcanisation.

Unfortunately this work had to be discontinued towards the end of 1949 owing to the claims of more immediate problems on the time of the staff and the departure to Malaya of the Senior Officer responsible for the investigations. A little work has been done, however, on the hardening of sole crepe kept at low temperatures (below 10°C). This hardness is helpful in the processing of sole crepe by shoe manufacturers and is usually obtained by keeping it for a long time in a cool room. The opinion was expressed by one manufacturer that some types of crepe soften more quickly than others when transferred to manufacturing department, but the results of modulus tests at a low elongation did not confirm this. Surprising evidence was obtained, however, that "freezing" led to permanent hardening of the rubber. Manufacturers frequently ask for information about factors affecting the hardness of sole crepe. A more detailed study is, therefore, being made of the effect of different conditions of freezing and thawing on a range of samples.

Latex

One of the objects of the work in London has been to ensure that the basic tests used by the trade, such as DRC., total solids and ammonia, are standardised in every detail so that reproducible results can be obtained irrespective of the operator and local conditions. This work has been done in association with other members of the B.S.I. Latex Sub-Committee and with the advice of a similar Committee in Malaya. As a result of this work detailed conditions for these tests were approved by the corresponding international organisation at a meeting held in Holland in 1949.

The chief difficulty in connection with trade tests on latex is in obtaining representative samples from large bulks of latex, particularly from those which tend to cream markedly on standing. A suitable procedure for thorough mixing of latex in drums was tried out, found to be satisfactory and approved internationally, but different opinions are still held about how to obtain representative samples from bulk supplies. No immediate solution of this difficulty is in sight, particularly as opportunity for gaining experience in the sampling of large supplies of creamed latex is not available in the U.K.

During 1950 most attention was given to the standardisation of a test for mechanical stability as proposed and developed by the Dunlop Rubber Co. Most of the details of this test have now been agreed internationally and it is expected that all outstanding differences of opinion will be resolved by the end of 1951.

Traces of copper and manganese compounds occur naturally in latex and sometimes have an adverse effect on the ageing properties of some manufactured articles. The American Society for Testing Materials have suggested a trade specification in which the permissible maximum amount of these constituents is fixed. Most latices have no difficulty in passing this specification, but experience indicates that determinations in different laboratories give different results. The Rubber Research Institute, therefore, supplied samples containing known amounts of added copper and these were shared amongst several laboratories in the U.K. In the first set of tests agreement was rather poor, but in a second set using a modified procedure agreement was satisfactory. There was, however, a tendency for the results to be a little low. During 1951 it is proposed to repeat these co-operative tests on a wider basis and to prepare a report for publication which should be of particular interest as an example of a new trend in industry for a number of different laboratories to combine in studying a problem affecting the whole of the industry. So far little has been done about manganese determinations but it is hoped to tackle the problem in the same way as copper determinations.

The various tests which have been studied and standardised during the last two years are essential to the smooth running of the latex trade. Nevertheless it is well known amongst large-scale users that established routine tests are not sufficient to differentiate between or explain some of the variations in the processing behaviour of different lots of latex. This is a source of difficulty in drawing conclusions from the examination by routine test methods of a wide range of samples containing different preservatives received from the Rubber Research Institute of Malaya. All except one, were in a good liquid condition showing no signs of premature coagulation. Some of them were more stable than others according to the mechanical stability test, but neither this test nor any other indicated how the latex would behave after it had been compounded for manufacturing purposes.

Similar views were expressed at the recent meeting of the Rubber Section of the International Standards Organisation in U.S.A. about the practical value of viscosity tests on uncompounded latex on which some work has been done by the Committee's staff comparing different methods. Nevertheless it is proposed to continue this work because presumably it is necessary to establish a satisfactory method for uncompounded latex, before a test for compounded latex can be devised.

It is evident that much more fundamental information is required about the properties of latex, but with the staff available this cannot be attempted at present. Efforts are being made, however, to study, on a laboratory scale, the behaviour of latex in important manufacturing operations; and it is hoped to apply the experience gained to the examination of the Malayan samples containing special preservatives.

ESTIMATES FOR 1950

(Adopted by the Board, November 6th, 1950)

INCOME

1. Cess Collections	..	..	..	Rs.	1,108,800
2. Government Grant for Smallholdings Work	..	..	..	..	168,500
3. Interest	..	..	..	..	70,000
4. Sale of Publications	..	..	..	..	1,000
5. Profit from Dartonfield Group Working	..	..	..	..	90,000
6. Sundry Receipts	..	..	..	..	4,000
				Rs.	<u>1,442,300</u>

REVENUE EXPENDITURE

1. ADMINISTRATION OF THE BOARD:—					Rs.
Travelling expenses of Board Members	..	..	..	..	4,500
2. PERSONAL EMOLUMENTS:—					
Senior Scientific Staff	..	..	..	Rs.	130,268
Junior Scientific Staff	..	..	..	..	21,314
					<u>151,582</u>
3. LIBRARY AND PUBLICATIONS:—					
Library	..	..	..	Rs.	5,000
Publications	..	..	..	..	5,000
					<u>10,000</u>

4. SMALLHOLDINGS DEPARTMENT:—

Salaries and Allowances	Rs.	185,598	
Travelling and General Expenses	„	75,110	260,708

5. LABORATORY:—

Equipment and Working Expenses	Rs.	8,000	
Furniture Replacements	„	500	8,500

6. FIELD AND FACTORY EXPERIMENTS:—

Field Experiments	Rs.	7,245	
Factory Experiments	„	3,000	10,245

7. OFFICE:—

Salaries of Office Staff	Rs.	24,819	
Stationery and Office Equipment	„	3,000	
Postages and Telegrams	„	3,000	
Advertising	„	1,000	
Telephone	„	1,200	
Audit	„	1,500	34,519

8. TRAVELLING EXPENSES OF STAFF:—

Officers' Expenses			20,000
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9. MAINTENANCE OF BUILDINGS:—

General Buildings	Rs.	1,300	
Bungalows	„	8,000	
Water and Power Supply	„	4,000	
Bungalow Furniture Replacements	„	3,000	
Motor Vehicles	„	7,000	23,300

10. MISCELLANEOUS ITEMS SHARED WITH ESTATES:—

Dartonfield Group General Charges	Rs.	78,990	
Upkeep of Roads and Grounds	„	1,200	
Factory Upkeep	„	8,062	
Power Supply	„	9,850	98,102

11. OTHER CHARGES:—

Contribution to London Advisory Committee	Rs.	31,200	
Contingencies	„	1,600	
Insurance Charges	„	7,500	
Staff Provident Fund	„	56,350	
Passages	„	15,000	
Entertainment Allowance	„	500	
Dearness Allowance to Staff	„	78,000	
Contribution to Medical Fund	„	3,500	
Social Services	„	2,000	195,650

12. Depreciation :—

.. ..	„	32,500
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Rs. 849,606

CAPITAL ACCOUNT

IMMATURE AREAS (*Dartonfield Group*):—

Dartonfield	..	..	..	Rs.	13,041	
Nivitigalakele	..	..	..	"	8,086	
Hedigalla	..	..	..	"	39,987	61,114

BUILDINGS:—

2 Intermediate Staff Bungalows—Dartonfield	..	..	..	Rs.	80,000	
1 Intermediate Staff Bungalows—Hedigalla	..	..	..	"	40,000	
2 Junior Staff Bungalows—Hedigalla	..	..	..	"	25,000	
4 Double cottages—Hedigalla	..	..	..	"	15,000	
8 Double cottages—Dartonfield	..	..	..	"	30,000	
Store and Garages—Dartonfield	..	..	..	"	5,000	195,000

IMPROVING GENERAL AMENITIES AT DARTONFIELD AND HEDIGALLA:—

Additional Water Supply—Dartonfield	..	..	..	Rs.	10,000	
Indoor Sanitation for Junior Staff Bungalows—						
Dartonfield	..	..	..	"	15,000	
Water Supply at Hedigalla	..	..	..	"	10,000	
Furniture improvements	..	..	..	"	6,500	
Refrigerators	..	..	..	"	8,500	50,000

LABORATORY AND FACTORY EQUIPMENT:—

Equipment for Chemist	..	..	..			50,000
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OFFICE EQUIPMENT:—

6 Steel Filing Cabinets	..	..	..	..		2,000
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Rs. 358,114

SUMMARY

INCOME	..	..	..	..	Rs.	1,442,300
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EXPENDITURE:—

Revenue	..	..	..	Rs.	849,606	
Capital	..	..	..	"	358,114	1,207,720

EXCESS OF INCOME OVER EXPENDITURE	..	..	..	..	Rs.	<u>234,580</u>
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AUDITOR GENERAL'S REPORT FOR 1949

The Chairman,
Board of Management,
Rubber Research Scheme,
Usk Valley,
Latpandura.

Audit Office,
Colombo, 23rd November, 1950

The accounts of the Rubber Research Scheme, Agalawatta (Ceylon) for the year ended December, 31, 1949, were audited under my direction. The financial statements:—

- (a) Dartonfield Estate Working Account ;
- (b) Nivitigalakele Experiment Station Working Account ;
- (c) Revenue Account, Capital Account and General Balance Sheet, and
- (d) Provident Fund Working Account,

were compared with the books and accounts and found to agree. The statements are returned herewith duly certified.

I.—INCOME

2. **Rs. 1,271,273.53.** The actual income for the year amounted to Rs. 1,303,269.84 although a sum of Rs. 1,271,273.53 only is shown in the Revenue Account. The difference of Rs. 31,996.31 is due to the fact that the cess collections at the ports other than Colombo for the period June to December 1949 had not been included in the Account as the collections were intimated by the Principal Collector of Customs to the Scheme only on 9th August 1950. The total income exceeded the estimate by Rs. 719,916.84.

3. A comparison between the approved Estimates and the actual income under the different accounts is shown in Statement 'A' attached. The reasons for the variations between the estimates and the actual income as furnished by the Director are shown against the respective items in the statement.

4. **Profit from Dartonfield Estate**—The profit for the year under review was Rs. 20,924.21 as compared with Rs. 5,581.19 in the previous year.

5. **Profit from Nivitigalakele Experiment Station**—The working of this experiment station for the year under review showed a profit of Rs. 23,825.52 as compared with Rs. 11,667.02 in the previous year.

II—EXPENDITURE

6. **Revenue Expenditure**—The total expenditure on revenue account exclusive of the amount allowed for depreciation of fixed assets and Audit Fee Reserve amounted to Rs. 597,323.97 as compared with Rs. 411,099.12 for the previous year. The details of this expenditure are fully set forth in the Revenue Account. The whole of this expenditure was checked with supporting vouchers and accounts.

7. **Capital Expenditure**—The expenditure incurred on fixed Capital Assets during the year amounted to Rs. 117,078.34 as compared with Rs. 118,315.30 for the previous year. The details of this expenditure are shown in the Capital Account.

8. A comparison between the approved estimates and the expenditure incurred during the year is shown in Statement 'B' attached. The reasons for the major variations between the Estimates and the actual expenditure as furnished by the Director are shown against the respective items in the Statement.

9. Unauthorised Excesses—

(a) Under Revenue Expenditure there have been excesses on 15 items aggregating Rs. 44,131.11 and an expenditure of Rs. 700/- has also been incurred on a new item viz., Grant to Junior Staff Recreation Club for which no provision had been made.

(b) Under Capital Expenditure the provision has been exceeded on four items by a total sum of Rs. 895.33 and an expenditure of Rs. 4,512.73 has been incurred on a new item viz. Water and Power Supply Dartonfield for which no provision had been made.

Covering sanction will have to be obtained for these excesses and unauthorised expenditure.

III—CAPITAL ACCOUNT

10. The total expenditure on Capital Account at 31.12.48 was Rs. 1,180,389.98. During the year under review capital expenditure amounted to Rs. 117,078.34 thus bringing the total capital cost up to Rs. 1,297,468.32 at 31.12.49.

IV—BALANCE SHEET

11. (a) **Liabilities—Creditors—Rs. 141,616.95**—This amount represents (a) the sums due to creditors for goods purchased or services rendered during the year.

(b) the amount received in advance from Govt. on account of its grant of Rs. 164,564/- for 1949-50 for small holdings work, and soil conservation, and

(c) the amounts paid in advance for subscriptions for 1950 publications.

12. **Passage Fund Reserve—Rs. 30,745.86**—The balance on 31st December 1948 was Rs. 25,913.92 and a sum of Rs. 15,000/- was transferred to this fund during the year. A sum of Rs. 10,168.06 was utilised during the year in connection with the Sea and Air Passages of the members of the Senior Staff. This reduced the total to the credit of the Fund to Rs. 30,745.86.

13. **Depreciation Reserve—Rs. 259,303.63**—This amount represents the amount set apart for the depreciation of the fixed assets of the Scheme. The amount transferred from Revenue to this Account during the year was Rs. 27,227.25 made up as follows:—

DARTONFIELD—

Buildings at 3½% on Rs. 265,836.21	.. ..	Rs.	9,304.27
Furniture and Fixed Equipment at 7½% on Rs. 32,304.47	.. ..	..	2,422.84
Water and Power Supply at 7½% on Rs. 32,626.62	.. ..	..	2,447.00
Accumulators (in new Storage Battery House)			
at 20% on Rs. 13,013.44	.. ..	..	2,602.69
Machinery and Tools at 7½% on Rs. 69,014.31	.. ..	..	5,176.07

NIVITIGALAKELE

Buildings at 3½% on Rs. 47,444.90	.. ..	..	1,660.57
Furniture and Fixed Equipment at 7½% on Rs. 2,453.45	.. ..	..	184.01
Water and Power Supply at 7½% on Rs. 2,451.43	.. ..	..	183.86
Machinery and Tools at 7½% on Rs. 3,881.92	.. ..	..	291.14

HEDIGALLA—

Buildings at 3½% on Rs. 56,314.71	.. ..	..	1,971.01
Furniture and Fixed Equipment at 7½% on Rs. 1,283.93	.. ..	..	96.29
Water and Power Supply at 7½% on Rs. 551.48		..	41.36
Laboratory Apparatus at 7½% on Rs. 11,281.88		..	846.14

Rs.			<u>27,227.25</u>
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14. **Provident Fund Reserve—Rs. 163,013.68**—The balance to the credit of the Fund at the end of 1948 was Rs. 136,131.46 and additions during the year under review amounted to Rs. 70,170.57. A sum of Rs. 43,288.35 was paid out to officers who retired during the year. This reduced the total to the credit of the Fund to Rs. 163,013.68.

15. **Medical Fund—Rs. 12,493.71**—The balance to the credit of this Fund at the end of 1948 was Rs. 10,140.56 and additions during the year under review amounted to Rs. 5,696.50. A sum of Rs. 3,343.35 was paid out to the officers during the year.

16. **Audit Fee Reserve—Rs. 1,043.07**—The amount to the credit of this account at the beginning of the year was Rs. 1,164.39 and the amount provided for the year 1949 was Rs. 900/-. Payment during the year in respect of service for 1948 was Rs. 1,021.32.

17. **Reserve for Stabilisation of Income—Rs. 191,798.54**—No additions to this reserve were made during the year.

18. **Appreciation of Investments—Rs. 12,800.00**—Represents the amount by which the investments had appreciated in value as at 31.12.1949.

19. **Surplus Account—Rs. 641,001.42**—The balance to the credit of the account at the beginning of the year was Rs. 112,257.45. To this a sum of Rs. 645,822.31 has been added as excess of income over expenditure, and a sum of Rs. 117,078.34 has been deducted from the total being the contribution to Capital Outlay during the year leaving a sum of Rs. 641,001.42. If the sum of Rs. 31,996.31 representing the cess collections due for 1949 received in August 1950 referred to in paragraph 2 above is included in the account, the balance to the credit of the Surplus Account would be Rs. 672,997.73.

20. (b) **Assets—Debtors—Rs. 160,269.97**—This represents—

(a) Cess collections (Colombo) for December 1949 amounting to Rs. 93,199.07

(b) Cess collections from outports for the period January to May 1949, amounting to Rs. 41,502.26.

and (c) Sundry Revenue amounting to Rs. 25,568.64 which were outstanding at 31st December, 1949.

To this total should be added the sum of Rs. 31,996.31 being the cess collections due from outports from June 1949 to December 1949—*vide* para 2, which would bring the total under Debtors to Rs. 192,266.28. The two amounts of Rs. 93,199.07 and Rs. 41,502.26 and the sum of Rs. 31,996.31 have since been received in full. It will be seen therefore that this asset has been under-stated by Rs. 31,996.31.

21. **Advance Account—Rs. 14,843.46**—Of this amount Rs. 5,580.24 and Rs. 8,851.39 represent advances to the Superintendent of Dartonfield, Nivitigalakele and Hedigalla Estates and Smallholdings Propaganda Officer, respectively and Rs. 251.83 to the London Advisory Committee for sundry expenses. The amounts shown are the balances with them at 31.12.1949. The amount of Rs. 160/- shown against the Post Master General represents the sum deposited with him in respect of trunk-call and telephone services.

22. **Accrued Interests on Investments—Rs. 4,264.46**—This sum represents the amount of interest accrued for the year on the investments, but not received during the year. This has since been recovered.

23. **Payments in Advance—Rs. 8,296.94**—This represents certain expenditure incurred in 1949 in respect of the year 1950.

24. **Stocks—Rs. 2,830.24**—The balance of the Estate Stocks at the end of the year was made up as follows:—

DARTONFIELD—

Rice and Foodstuffs	..	..	..	Rs.	641.57
Stocks of Materials	..	..	..	„	2,046.50

NIVITIGALAKELE—

Rice and Foodstuffs	..	..	..	„	142.17
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Rs. 2,830.24

The balances have been verified by a Board of Survey at the end of the year.

25. **Loan to Hataraliyadda Co-operative Society—Rs. 700.00**—Of the sum of Rs. 1,000/- outstanding at the beginning of the year, a sum of Rs. 300/- was repaid during the year leaving a balance of Rs. 700/- still due.

26. **Loans to Officers—Rs. 33,135.02**—This represents the total amount outstanding on 31.12.49 from officers to whom loans were granted for the purchase of means of transport.

27. **Investments—Rs. 812,800/-** —Details of the investments are shown in the Balance Sheet at Middle Market Value at 31.12.1949. The certificates in support of the investments were seen.

28. **Cash Balances—Rs. 416,682.77**—Details of this figure are shown in the Balance Sheet. The Fixed Deposit of Rs. 100,000/- at the beginning of the year was transferred on maturity in October 1949 to Current Account No. 1. The Pass Books in respect of the Savings Bank Accounts were seen. The balances in current account Nos. 1 and 2 were verified by reference to Bank certificates and Reconciliation Statements. The balance of cash in hand at 31st December 1949 was not verified, but a surprise verification of the cash in hand was made on 4.8.1950.

V—GENERAL

The accounts were received quarterly and audited in this office. The office of the Scheme at Dartonfield Estate was visited once in respect of the accounts of the year under review and the books and accounts kept were checked and cash in hand verified.

(Sgd.) P. W. KAULE,
for Auditor General.

REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1949

Rs. 1,271,273 53

CAPITAL ACCOUNT AS AT 31st DECEMBER, 1949

RECEIPTS

	To December 31st 1948	Transfers between Accounts	Additions in 1949	Total					R ^s	C.
	R ^s .	C.	R ^s .	C.	R ^s .	C.				
TO LAND INCLUDING DEVELOPMENT:							By Revenue applied for Capital purposes			
Dartonfield ..	135,192.73		2,610.38	137,803	11		At December, 1948 Rs.	1,180,389.98		
Nivitigalakele..	152,021.81		3,182.88	155,204	69		In 1949 "	117,078.34	1,297,468	32
Hedigalla ..	126,250.70		20,777.60	147,028	30					
" BUILDINGS AND LINES:										
Dartonfield Estate ..	86,913.44		7,454.18	94,367	62					
Headquarters	267,717.30		22,834.81	290,552	11					
Nivitigalakele—Estate ..	40,256.01		—	40,256	01					
Headquarters	21,993.03		—	21,993	03					
Hedigalla—Estate ..	41,081.10		3,855.43	44,936	53					
Headquarters	17,673.16		955.46	18,628	62					
" FURNITURE AND FIXED EQUIPMENT:										
Dartonfield ..	57,005.32		3,879.76	60,885	08					
Nivitigalakele..	5,733.70		—	5,733	70					
Hedigalla ..	1,423.63		340.62	1,764	25					
" POWER AND WATER SUPPLY:										
Dartonfield ..	70,570.36		19,398.11	89,968	47					
Nivitigalakele	5,128.09		—	5,128	09					
Hedigalla ..	608.00		271.70	879	70					
" MACHINERY AND TOOLS:										
Dartonfield ..	106,124.88		30,694.04	136,818	92					
Nivitigalakele..	4,754.23		—	4,754	23					
" LABORATORY: Apparatus ..	28,609.15		823.37	29,432	52					
London Plant	11,333.34		—	11,333	34					
	R ^s .								R ^s .	
	1,180,389.98		117,078.34	1,297,468	32				1,297,468	32

GENERAL BALANCE SHEET AS AT 31st DECEMBER, 1949

[illegible]

The Accounts of the Rubber Research Scheme above set forth have been Audited under my direction. I have obtained all the information and explanations that I have required and I certify as a result of this audit that in my opinion, the Balance Sheet is properly drawn up so as to exhibit a correct view of the state of affairs of the Scheme as at 31st December 1949, subject to the observations in the accompanying report.

Audit Office,
Colombo, 23rd November, 1950.

(Sgd.) P. W. KAULE,
for Auditor General.

DARTONFIELD ESTATE

WORKING ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1949

Dr.										Cr.
To EXPENDITURE:—				R ^s .	C.	By SALES:—				R ^s . C.
General Charges		R ^s .	24,757.74							
Upkeep, Manufacture and Distribution		"	20,411.63	45,169	37	Manufactured rubber (93,505 lbs.)				67,069 03
„ LOSS ON CARTING ACCOUNT				750	81					
„ LATEX CREAMING:—										
Expenditure		R ^s .	6,324.34							
Less amount recovered for creaming 12,199.4 gallons latex		"	6,099.70	224	64					
„ Balance being excess of Income over expenditure transferred to Revenue Account				20,924	21					
				R ^s .	67,069 03					R ^s . 67,069 03

NIVITIGALAKELE EXPERIMENT STATION
WORKING ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1949

Dr.			Rs.	C.				Rs.	Cr.
TO EXPENDITURE:—					BY SALE OF PRODUCE:—				
General Charges	..	Rs.	11,290.42		Manufactured rubber (67,928 lbs.)..	..	..	47,813	54
Upkeep, Manufacture and Distribution	..	"	12,671.77	23,962 19	Planting Material	..	..	1,935	23
„ UPKEEP OF NURSERIES	..	..		1,275 82					
„ HANDLING AND DISTRIBUTION OF BUDWOOD AND BUDDED STUMPS	..	..		683 02					
„ HARVESTING OF FOOD CROPS	..	..		2 22					
„ BALANCE BEING EXCESS OF INCOME OVER EXPENDITURE TRANSFERRED TO REVENUE ACCOUNT	..	..		23,825 52					
			Rs.	<u>49,748 77</u>				Rs.	<u>49,748 77</u>

PROVIDENT FUND

WORKING ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1949

[illegible]

INCOME FOR 1949

	Estimate Account Rs.	Actual Income Rs.	Excess Rs.	Deficit Rs.	
Cess Collections	420,000	1,047,781.48	627,781.48		Increase in rate of cess
Interest	10,700	15,475.20	4,775.20		Larger investments
Sale of Publications	1,000	1,060.86	60.86		
Profit from Dartonfield (Loss)	1,757	20,924.21	22,681.21		More crop and underestimate of selling prices
Profit from Nivitigalakele (Loss)	5,550	23,825.52	29,375.52		do.
Sundry Receipts	2,460	4,181.61	1,721.61		Rent on bungalows and royalty on timber.
Government Grant for Smallholdings Work	156,500	157,391.00	891.00		

STATEMENT "B"

STATEMENT OF EXCESSES AND SAVINGS ON VOTES

Head of Estimate	ACCOUNT	Estimate Rs. C.	Capital Rs. C.	Revenue Rs. C.	Excess Rs. C.	Saving Rs. C.	Remarks
1.	ADMINISTRATION OF THE BOARD:— Travelling Expenses of Board Members and Allowance to Chairman	7,570.00 ..	— ..	1,523.55 ..	— ..	6,046.45 ..	Allowance to Chairman not paid.
2.	EMOLUMENTS OF SENIOR SCIENTIFIC STAFF	102,010.00 ..	— ..	98,899.43 ..	— ..	3,110.57 ..	Non employment of full staff.
3.	EMOLUMENTS OF JUNIOR SCIENTIFIC STAFF	24,820.00 ..	— ..	25,864.25 ..	1,044.25 ..	— ..	General increase of salary scales.
4.	LIBRARY AND PUBLICATIONS:— A. Library	1,500.00 ..	— ..	3,138.03 ..	1,638.03 ..	— ..	Binding Charges.
	B. Publications	3,500.00 ..	— ..	3,080.95 ..	— ..	419.05 ..	Fewer publications issued.
5.	SMALLHOLDINGS WORK:— A—G & I—G Emoluments of Staff	130,660.00 ..	— ..	142,256.70 ..	11,596.70 ..	— ..	General increase of salary scales.
	H & K—L. Travelling & General Expenses	69,140.00 ..	275.00 ..	51,789.44 ..	— ..	17,075.56 ..	Overestimate.
6.	LABORATORY:— A. Equipment and Working Expenses	23,700.00 ..	823.37 ..	5,315.65 ..	— ..	17,560.98 ..	Payments not complete.
	B. Furniture Replacements	50.00 ..	— ..	43.50 ..	— ..	6.50 ..	
7.	FIELD AND FACTORY EXPERIMENTS:— A. Field Experiments	5,260.00 ..	— ..	1,747.39 ..	— ..	3,512.61 ..	Less Experiments undertaken.
	B. Factory Experiments	3,820.00 ..	— ..	3,867.94 ..	47.94 ..	— ..	Underestimate.
8.	OFFICE:— A—C. Emoluments of Office Staff	18,620.00 ..	— ..	23,498.86 ..	4,878.86 ..	— ..	General increase of salary scales.
	D. Stationery and Office Equipment	3,500.00 ..	— ..	3,477.76 ..	— ..	22.24 ..	
	E. Postages and Telegrams	3,000.00 ..	— ..	1,774.67 ..	— ..	1,225.33 ..	Overestimate.
	F. Advertising	800.00 ..	— ..	2,332.26 ..	1,532.26 ..	— ..	More vacancies and wider range of advertisements.
	G. Telephone	1,200.00 ..	— ..	1,620.48 ..	420.48 ..	— ..	Diversion of a bungalow extension line.
	H. Audit	900.00 ..	— ..	900.00 ..	— ..	— ..	
9.	TRAVELLING EXPENSES OF STAFF	7,000.00 ..	— ..	10,533.84 ..	3,533.84 ..	— ..	More travelling undertaken.
10.	MAINTENANCE OF BUILDINGS WATER AND POWER SUPPLY AND STATION WAGGON:— A. General buildings	500.00 ..	— ..	420.01 ..	— ..	779.99 ..	Less work undertaken.
	B. Bungalows	5,500.00 ..	— ..	5,333.35 ..	— ..	166.65 ..	do.
	C. Water and Power Supply	3,000.00 ..	— ..	3,305.58 ..	305.58 ..	— ..	Unexpected repairs to pumps and Engine.
	D. Furniture Replacements	600.00 ..	— ..	511.72 ..	— ..	88.28 ..	Economies.
	E. Station Wagon	2,000.00 ..	— ..	1,752.85 ..	— ..	247.15 ..	Overestimate.
11.	MISCELLANEOUS ITEMS SHARED WITH ESTATE:— A. Dartonfield General Charges	28,370.00 ..	— ..	26,060.78 ..	— ..	2,309.32 ..	Overestimate in dearness allowance.
	B. Nivitigalakele General Charges	13,512.00 ..	— ..	12,544.92 ..	— ..	967.08 ..	do.
	C. Hedigalla General Charges	9,874.00 ..	— ..	9,191.10 ..	682.90 ..	— ..	Increase of salary scales.
	D. Upkeep of Roads and Grounds	1,125.00 ..	— ..	990.61 ..	— ..	134.39 ..	Less work undertaken.
	E. Factory Upkeep	2,100.00 ..	— ..	2,281.06 ..	181.06 ..	— ..	Unanticipated Engine repair.
	F. Power Supply	10,559.00 ..	— ..	11,462.70 ..	903.70 ..	— ..	Increased cost of oil.
12.	CONTINGENCIES:— A. Contribution to London Advisory Committee	27,000.00 ..	— ..	26,713.04 ..	— ..	286.96 ..	Difference in exchange.
	B. General Charges	1,000.00 ..	— ..	1,444.56 ..	444.56 ..	— ..	Unanticipated legal fees.
	C. Insurance Charges	5,500.00 ..	— ..	4,578.10 ..	— ..	921.90 ..	Non completion of building programme.
	D. Staff Provident Fund	29,000.00 ..	— ..	45,746.95 ..	16,746.95 ..	— ..	Underestimate due to general insurance of salaries.
	E. Passages	15,000.00 ..	— ..	15,000.00 ..	— ..	— ..	
	F. Entertainment Allowance	150.00 ..	— ..	324.00 ..	174.00 ..	— ..	Increased rates of allowance.
	G—H. War Allowance to Staff	56,000.00 ..	— ..	44,059.14 ..	— ..	11,940.86 ..	Overestimate of rate.
	I. Contribution to Medical Fund	3,300.00 ..	— ..	2,773.00 ..	— ..	527.00 ..	Full Junior Staff not contributing.
13.	DEPRECIATION	30,350.00 ..	— ..	27,227.25 ..	— ..	3,122.75 ..	Due to non completion of building programme and sale of equipment.
14.	PLANTING FOOD CROPS AT HEDIGALLA	750.00 ..	— ..	— ..	— ..	— ..	Realised Rs. 633/65 Profit from sale of food crops.
15.	CAPITAL ACCOUNT:— A. Upkeep of Dartonfield Immature Areas	2,068.00 ..	2,503.47 ..	— ..	435.47 ..	— ..	Underestimate in weeding and Pests and Diseases.
	B. Upkeep of Nivitigalakele Immature Areas	4,148.00 ..	2,971.83 ..	— ..	— ..	1,176.17 ..	Overestimate on field work.
	C. Upkeep of Hedigalla Immature Areas	14,925.00 ..	10,944.53 ..	— ..	— ..	3,980.47 ..	do.
	D. Hedigalla 1949 New Planting	11,706.00 ..	8,333.17 ..	— ..	— ..	3,372.83 ..	do.
	E. 1 Junior Staff Bungalow at Dartonfield	11,000.00 ..	— ..	— ..	— ..	11,000.00 ..	Work not undertaken.
	F. Alterations to Junior Staff Bungalow No. 12	300.00 ..	300.00 ..	— ..	— ..	— ..	
	G. Electric Lights to Junior Staff Bungalows	14,989.00 ..	14,885.38 ..	— ..	— ..	103.62 ..	Overestimate.
	H. Tennis Court renovation	200.00 ..	106.91 ..	— ..	— ..	93.09 ..	Overestimate.
	I. School & Creche, and School Master's Qrs.	491.00 ..	— ..	— ..	— ..	491.00 ..	Work not undertaken.
	J. Smokehouse for Hedigalla	5,000.00 ..	— ..	— ..	— ..	5,000.00 ..	Work not undertaken.
	K. 1 Pair Hand rollers and Coagulating Pans for Hedigalla	2,150.00 ..	— ..	— ..	— ..	2,150.00 ..	Hand rollers not purchased.
	L. Furniture & Fixed Equipment	3,622.00 ..	3,302.26 ..	— ..	— ..	319.74 ..	Purchases of equipment not complete.
	M. Hedigalla Cart Road Extension	10,921.00 ..	1,499.90 ..	— ..	— ..	9,421.10 ..	Work not complete.
	N. 2 double Labourers' Cottages (Dartonfield)	7,427.00 ..	7,454.18 ..	— ..	27.18 ..	— ..	
	O. 2 double Labourers' Cottages (Hedigalla)	8,407.00 ..	32.76 ..	— ..	— ..	8,374.24 ..	Work not undertaken.
	P. Hedigalla Coagulating Shed and Store	4,000.00 ..	4,094.37 ..	— ..	94.37 ..	— ..	Underestimate.
	Q. Hedigalla New Planting (Nursery)	2,842.00 ..	— ..	— ..	— ..	2,842.00 ..	Work not undertaken.
	R. Hand rollers and Coagulating tank (Nivitigalakele)	1,029.00 ..	— ..	— ..	— ..	1,029.00 ..	Hand rollers not purchased.
	S. Junior Staff Bungalows (Hedigalla)	3,821.00 ..	1,296.08 ..	— ..	— ..	2,524.92 ..	Water supply not installed and furniture for one bungalow not purchased.
	T. Secretary-Accountant's Bungalow	15,506.00 ..	15,844.31 ..	— ..	338.31 ..	— ..	Underestimate.
	U. Carpenter's Shed (Dartonfield)	298.00 ..	— ..	— ..	— ..	298.00 ..	Work not undertaken.
	V. Quadruple Cottages for Labourers	287.00 ..	211.05 ..	— ..	— ..	75.95 ..	Overestimate.
	W. New National Engine for Dartonfield	25,798.00 ..	25,591.62 ..	— ..	— ..	206.38 ..	do.
	X. Station Wagon and Lock-up Garage	14,000.00 ..	12,095.42 ..	— ..	— ..	1,904.58 ..	do.
	Y. Grant to Junior Staff recreation club	— ..	— ..	700.00 ..	— ..	— ..	
	Z. Water and Power Supply Dartonfield	— ..	4,512.73 ..	— ..	— ..	— ..	

